OPINIONS OF THE PRESS.

Dublin Quarterly Journal of Medical Science.

"Within its necessarily moderate limits is contained all the information, on the important subject of which it treats, which the practising physician can require. And it is in this attempt to meet the wants of all—as well graduates as students—that we feel bound to congratulate Dr Scoresby-Jackson on his well-merited success. . . . The volume is of convenient size, the letter-press good and extremely accurate, and we feel we are but doing our duty in sincerely recommending the work to every member of the profession, be he student or physician."

Edinburgh Medical Journal.

"It is really a complete, though, of course, condensed treatise on Materia Medica and Therapeutics, and will be useful not only to Dr Scoresby-Jackson's own pupils, but to medical students in general, and to practitioners."

Medical Mirror.

"We have seen no book on Materia Medica which we can more heartily recommend, both to the student of medicine, and to those working practitioners who require a treatise that goes at once to the root of a question, and which, while giving nothing beyond the subject, yet at the same time omits nothing of real importance."

The Medical Press and Circular.

"Dr Scoresby-Jackson has presented the profession with one of the most full and comprehensive works upon the Materia Medica, and upon the art of prescribing remedies, which has for long appeared in an English dress. This little work is a perfect model of condensation and accuracy. There is, perhaps, no known remedy, officinal or otherwise, which does not find a place in its pages, and its very index is made to convey the most important information—the dose of the drug referred to—so that in turning it up, a practitioner will often get all he wants to know. The remaining part of this work is occupied by a condensed yet clear and concise account of the natural history, composition, preparations, actions, and uses of the various articles comprising the Materia Medica; not merely those which are officinal or comprised in the British Pharmacopœia, but also including many others, which, though excluded from that work,

are yet deservedly prized by many practitioners of medicine. It would occupy too much space to enter upon a detailed consideration of this part of the work; it is sufficient to say, that it is executed with the same diligent care evinced in the introductory part, and that in its construction the interests of both practitioners and students have been carefully consulted. This little work is dedicated by permission to Professor Christison, and the highest praise that can be bestowed upon it is to say, that it is not only not unworthy to be so dedicated, but also not unworthy of the high reputation which Professor Christison has won for the Edinburgh Medical School in the matter of Materia Medica, Pharmacology, and Therapeutics."

British Medical Journal.

"This work has been written by Dr Scoresby-Jackson as a note-book for the students attending his Lectures on Materia Medica; and he has done well in publishing it. It consists of three parts :—I. Introductory, in which the Author comments on the Materia Medica, Pharmaceutical Operations, Prescriptions, Modus Operandi of Medicines, and other General Matters ; II. The Inorganic Materia Medica ; III. The Organic Materia Medica. The book is one which scarcely admits of analysis; we can therefore only say that, although concise, it is apparently very complete, and contains notices not only of Pharmacopœial preparations, but of other medicines which have been brought into use. Dr Scoresby-Jackson's *Note-Book* has a modest title ; but it deserves to take an honourable place among our text-books of Materia Medica."

NOTE-BOOK

OF

MATERIA MEDICA.

NOTE-BOOK

OF

MATERIA MEDICA,

PHARMACOLOGY AND THERAPEUTICS.

BY

R. E. SCORESBY-JACKSON, M.D., F.R.S.E.,

ETC., ETC., ETC.

Second Edition,

REVISED, ENLARGED, AND BROUGHT DOWN TO THE PRESENT DATE,

BY

DR ANGUS MACDONALD, M.A.,

FELLOW OF, AND EXAMINER IN CHEMISTRY TO, THE ROYAL COLLEGE OF PHYSICIANS; FORMERLY LECTURER ON MATERIA MEDICA AND THERAPEUTICS, SURGEONS' HALL, EDINBURGH.

EDINBURGH:

MACLACHLAN & STEWART, 64 SOUTH BRIDGE,

BOOKSELLERS TO THE UNIVERSITY.

LONDON: SIMPKIN, MARSHALL, AND CO.

MDCCCLXXI.

EDINBURGH:
PRINTED BY LORIMER AND GILLIES,
CLYDE STREET.

Dedicated,

BY PERMISSION,

TO

ROBERT CHRISTISON, ESQ., M.D., V.P.R.S.E.,

PROFESSOR OF MATERIA MEDICA IN THE UNIVERSITY OF EDINBURGH, ETC.

WITH EVERY SENTIMENT OF RESPECT AND ESTEEM,

BY HIS FORMER PUPIL,

THE AUTHOR.

PREFACE TO THE FIRST EDITION.

In order to relieve the students attending my lectures as much as possible from the irksomeness of note-taking, I prepared, two years ago, a pamphlet containing all the formulæ, the weights and measures, &c., of the British Pharmacopœia, printed it, and offered it for their acceptance. I found that this *Note-Book of Formulæ*, as it was called, was of some use, and I hoped to have made it still more so by enlarging it a little before presenting a second edition. Just as I was about to do so, however, I received a communication from the publishers of this book, asking me to place in their hands what I thought would be useful to the student of Materia Medica.

In responding to their request, I have endeavoured to prepare a work which will relieve the student from much of the mechanical labour of note-taking, and which, whilst it supplies a good deal of useful information, will suggest the necessity of a more complete investigation of the subject.

In preparing the book for press, I have considerably exceeded the limits of my first intention; so difficult is it to keep back what we desire that others should participate in. But still it is only a *Note-Book*, and its aim is to be suggestive rather than dogmatic.

All quotations from the Pharmacopœia are made in italics. The names of officinal drugs are printed in bolder type, and

may thus be distinguished from others which are not officinal. The officinal drugs, preparations, and compounds are distinguished in the index by an asterisk.

I have to express my thanks to many kind friends who have advised me upon various points during the progress of the work, especially to Professor Balfour, whose *Class-Book of Botany* I have followed in the arrangement of the Natural Orders; to Dr Seller, examiner in Medicine in the University of Edinburgh; to my colleague, Dr Stevenson Macadam, lecturer on Chemistry, and to Mr J. B. Stephenson, pharmaceutical chemist.

32 Queen Street Edinburgh,
May 1866.

PREFACE TO THE SECOND EDITION.

In preparing a new edition of the "Note-Book," the Editor, in accordance with the wishes of the relatives of Dr Scoresby-Jackson, has strictly adhered to the original plan of the work. All the new preparations introduced into the British Pharmacopœia of 1867 are included in the present edition.

The whole work has been subjected to a rigid revisal; many of the articles, such as Bromide of Potassium, Sulphurous Acid, the Sub-nitrate of Bismuth, Arsenious Acid, Conium, Digitalis, &c., have been almost entirely re-written; whilst several additions have been made, such as the Solution of Bismuth, the Hydrate of Chloral, Carbolic Acid, &c. As the book is principally intended for Students accustomed to the new notation only, the formulæ employed in explanation of chemical reactions have been converted into this system throughout. To facilitate reference to older works, the constitution in symbols of substances possessed of definite chemical composition has been generally given, along with their names, in the old as well as the new notation. Now that the new system is used exclusively by

Teachers of Chemistry, it seemed on the whole unnecessary to adopt a separate type for each notation, as is done in the British Pharmacopœia.

Every precaution has been taken to render the work as useful, accurate, and complete a Student's Text-Book as possible, and worthy of a continuance of that popularity it has already attained.

41 Northumberland Street,
Edinburgh, *Dec.* 1870.

CONTENTS.

PART I.—INTRODUCTORY.

PART II.—INORGANIC MATERIA MEDICA.

CLASS I.—METALLOIDS OR NON-METALLIC BODIES.

CLASS II.—CERTAIN ACIDS WHICH MAY BE CONVENIENTLY CONSIDERED TOGETHER.

CLASS III.—METALS.

PART III.—ORGANIC MATERIA MEDICA.

DIVISION I.—VEGETABLE KINGDOM.

A. *Phanerogameæ, Cotyledoneæ, or Flowering Plants.*

CLASS I.—DICOTYLEDONES, EXOGENÆ, OR ACRAMPHYBRIA.

SUB-CLASS I.—THALAMIFLORÆ.

SUB-CLASS II.—CALYCIFLORÆ.

1.—*Polypetalæ or Dialypetalæ.*

2. *Monopetalæ or Gamopetalæ.*

SUB-CLASS III.—COROLLIFLORÆ.

1. *Hypostaminiæ.*

2. *Epicorollæ or Epipetalæ.*

SUB-CLASS IV.—MONOCHLAMYDEÆ OR APETALÆ.

1. *Angiospermæ.*

LIST OF BOOKS

REFERRED TO IN THE

BRITISH PHARMACOPŒIA, AS CONTAINING PLATES OF OFFICINAL PLANTS.

Asiatic Researches. 20 vols. 4to. Calcutta, 1788–1836.

BERG UND SCHMIDT, Darstellung und Beschreibung sämmtlichen in der Pharmocapœa Borussica aufgeführten offizinellen Gewächse. 4 vols. 4to. Leipzig, 1858–1863.

Botanical Magazine. 8vo. London, 1787–1867.

Botanical Register. 33 vols. 8vo. London, 1815–1847.

English Botany. Smith & Sowerby. 36 vols. 8vo. London, 1790–1814.

Flora Londinensis. Curtis. 6 fasciculi, folio. London, 1777–1798.

HOOKER, *Journal of Botany.* 3rd Series, 9 vols. 8vo. 1849–1857.

HOWARD, *Illustrations of the Nueva Quinologia of Pavon.* Folio. London, 1862.

LAMBERT, *A Description of the genus Pinus.* 2 vols. folio. London, 1803, 1828.

NEES VON ESENBECK, *Plantæ Medicinales.* 2 vols. folio. Düsseldorf, 1828.

Pharmaceutical Journal. 8vo. London, 1842–1867.

Philosophical Transactions of the Royal Society. 4to. London, 1665–1867.

RISSO ET POITEAU, *Histoire Naturelle des Orangers.* Folio. Paris, 1818.

ROXBURGH, *Plants of the Coast of Coromandel.* 3 vols. folio. London, 1795–1819.

ROYLE, *Illustrations of the Botany of the Himalayan Mountains, and of the Flora of Cashmere.* 2 vols. 4to. London, 1839.

RUIZ AND PAVON, *Flora Peruviana et Chilensis.* 3 vols. folio. Madrid, 1798–1802.

RUMPHIUS, *Herbarium Amboinense.* 6 vols. folio. Amsterdam, 1741–1755.

STEPHENSON AND CHURCHILL, *Medical Botany.* 4 vols. 8vo. London, 1831.

Transactions of the Linnean Society. 4to. London, 1791–1867.

Transactions of the Royal Society of Edinburgh. 4to. Edinburgh, 1788–1866.

WALLICH, *Plantæ Asiaticæ rariores.* 3 vols. folio. London, 1830–1832.

WEDDELL, *Histoire Naturelle des Quinquinas.* Folio. Paris, 1849.

WIGHT, *Icones Plantarum Indiæ Orientalis.* 6 vols. 4to. Madras, 1838–1853.

WOODVILLE, *Medical Botany.* 4 vols. 4to. London, 1790–1794.

NOTE-BOOK

OF

MATERIA MEDICA, PHARMACOLOGY, AND THERAPEUTICS.

PART I.—INTRODUCTORY.

Materia Medica.—This term, in its most restricted sense, signifies nothing more than the medicinal substances used in the cure of disease, and hardly extends beyond the domain of the druggist; but in a more liberal view, it embraces all the means at our disposal for the alleviation of the sufferings which attend disease—except those involved in pure Surgery and Midwifery—and includes all those *Hygienic* appliances which of late years have been so rapidly developed.

There is no law to define rigidly the scope and arrangement of a course of lectures on Materia Medica, and therefore, to a certain extent, the teacher is left to frame a plan according to his own idea of the relative importance of the various branches of his subject. The ultimate object of lectures on Materia Medica is to teach the legitimate use of means to an end. The centre around which the lectures are grouped is the *Physician's prescription.* From the utmost verge of the subject, the thread upon which it hangs leads back to the prescription, not of drugs only, but of everything that can alleviate suffering and cure disease. The ultimate object of medical education is to teach *how to write a prescription*, and in that little act lies the severest test of a physician's attainments. To be examined upon a prescription is to give access to every department of medical learning. If the student could satisfactorily explain the *how, what, when,* and *why* of prescribing, his education

would be complete; but this is not to be attained during his *curriculum* merely, it is what the practitioner is still learning at the close of his career. The practical application of all the medical sciences culminates in the prescription; the ultimate object of Chemistry, Botany, Physiology, Pathology, and the other allied sciences, with respect to medicine, is to teach the physician how to apply the remedies at his disposal most advantageously to his patients.

Materia Medica is, as it were, surrounded by the medical sciences, so that in whatever direction we may advance we shall find ourselves approaching towards one or other of them. How far we may go without trenching upon the functions of another department, it is not easy to say. Attempts have been made to limit Materia Medica, and certain expressions have been coined to give it a locality. Such are—

Acology (ἄκος, *a remedy*, and λόγος) and *Iamatologia* ἴαμα, *a remedy*, and λόγος), terms which signify *a discourse on remedies.* Acology has been limited by some authors to the consideration of those mechanical remedies, which, pertaining rather to pure surgery, it is not our province to deal with.

Therapeutics (θεραπεύω, *I cure*) relates to the application of Materia Medica, and varies in the extent of its signification according to the limits put upon the latter expression. It is divided into *General Therapeutics* and *Special Therapeutics.*

Iatreusologia (ἰατρεύω, *I cure*, and λόγος) signifies a discourse on the art of curing, a term applied by Sprengel to General Therapeutics.

Dietetics (δίαιτα, *diet*) is a term relating, in a restricted sense, to treatment by *alimentary substances*, but in a wider meaning, it is synonymous with *Hygiene* (ὑγιαίνω, *I am well*), a term relating to that department of medicine which treats of the restoration and preservation of health by means not strictly pharmacological. The agencies used in this department are the six *non-naturals* of the ancients, *air*, *aliment*, *exercise*, *excretion*, *sleep*, and *affections of the mind.* The term *Regimen* (*rego*, *I rule*) is included in this department.

Pharmacology (φάρμακον, *a medicine*, and λόγος) signifies a discourse on medicines, or Materia Medica. It is divided into *General Pharmacology* and *Special Pharmacology*, and is subdivided into *Pharmacognosy*, *Pharmacy*, and *Pharmacodynamics.*

Pharmacognosy (φάρμακον, *a medicine*, and γιγνώσκω, *I know*) and *Pharmacy* (φάρμακον, *a medicine*), are terms relating to the

circumstances which affect the condition of simple and compound medicines during their passage from a state of nature to the physician's hand, viz., their source, collection, preservation, characters, qualities, purity, preparation, &c. The following terms are sometimes used synonymously—*pharmacography*, *pharmacomathy*, *pharmacotechny*, *pharmaconomia*, &c.

Pharmacodynamics (φάρμακον, *a medicine*, and δύναμις, *power*) relates to the actions and uses of medicines.

Sources and Natural Condition of Medicines.—Medicines are derived both from the organic and inorganic kingdoms, from animals, vegetables, and minerals. Besides these we use certain subtile imponderable agents, such as electricity, galvanism, heat, cold, and the like. Medicines are called *simple* when used individually, *compound* when two or more are incorporated. But many simple remedies are constituted of several active ingredients, any one of which, when isolated, is capable of producing a distinct medicinal effect. Take *opium* as an example of an individual remedy in one sense, but truly a very complex substance compounded in the laboratory of nature. The ponderable substances, except mineral waters, are rarely met with in a condition ready for use. They usually require certain operations to be performed upon them in order to fit or preserve them for medicinal application. These changes are wrought upon them by the pharmaceutist.

The Selection and Collection of Medicines.—In selecting medicines from the mineral kingdom, we must be careful to understand and thoroughly examine their qualities, and obtain them as pure as possible. Beyond this we have no general rules to guide us.

Medicinal plants are collected from either wild or cultivated sources. Comparatively few are produced in this country, the rest are imported. Wild plants are collected from their respective haunts by men known as *Simplers*, between whom and the profession is the middle-man, drug-merchant, herbalist, or pharmacopolist. *Simplers* are of ancient date; they are the representatives of the *Rhizotomi* of the Greeks, and *Herbarii* of the Romans. Cultivated plants are grown in various parts of the world, the chief medicine growing districts of this country being at Mitcham in Surrey, and Hitchin in Hertfordshire. The medicinal plants cultivated at Mitcham are chiefly lavender, peppermint, chamomiles, roses, liquorice, and henbane. Also large quantities of poppies, rosemary, squirting-cucumber, belladonna, and pennyroyal; and in smaller quantities, spearmint, marshmallow, horehound, foxglove,

stramonium, &c. At Hitchin the cultivation is at present chiefly restricted to lavender, elaterium, belladonna, henbane, and aconite. The distribution and cultivation of medicinal plants, as indeed of all plants, are restricted by natural laws, which are explained in works on botanical geography. But we are interested in this matter in a double point of view. It is not enough for us to know that a medicinal plant will grow in a foreign land, and present the same external characters as it does in its native soil, we must know also that its medicinal properties are alike under both conditions. Another question of importance is whether a plant that is medicinal in its wild state will preserve the same properties under cultivation; whether it is affected, medicinally, by the elevation at which it is grown, by its exposure more or less to light, by the kind of soil in which it is planted; whether it has the same medicinal value at all ages and at all seasons. In short, what is the effect of climate, soil, season, and cultivation upon medicinal plants? We have not much information to give in reply to this question. Much that has been stated in reference to it is vague and uncertain, and it is not easy to discriminate between the effects of one and another of these agencies.

We shall consider, 1. *The natural condition of a plant;* 2. *How the plant may be affected by a change in its circumstances;* 3. *Examples quoted as evidences of the influence of such change of circumstances.*

1. *The natural condition of a plant.* Plants are composed of *organic* and *inorganic* constituents. The *organic* constituents are common to all plants, and are four in number, Carbon, Hydrogen, Nitrogen, and Oxygen; in some cases, two more are added, Sulphur and Phosphorus, which enter into the composition of the sanguigenous elements in alimentary vegetables. The organic constituents largely preponderate in the constitution of plants; they are consumed when the plant is burned, and are decomposed by the united action of warmth and moisture. The *inorganic* constituents are comparatively small in quantity, are indestructible by heat, and do not undergo the process of putrefaction. They are not *universal*—*i. e.*, common to all plants—although some of them are widely distributed. They are more numerous than the organic constituents; they are Calcium, Magnesium, Potassium, Sodium, Iron, Manganese, Chlorine, Iodine, Bromine, Fluorine, Silicon, Sulphur, and Phosphorus. They vary in number and relative proportions in different plants, and do not exist in their elementary form, but are

taken up as soluble sulphates, phosphates, chlorides, carbonates, silicates, &c., dissolved in water. Though small in quantity, they are essential to the building up of the tissues of the plant.

A few sentences must suffice to explain the nourishment and growth of plants, following a dicotyledonous example. After the dormant period of winter has passed, the tender fibres of the roots begin the process of vegetation, by absorbing from the soil a supply of aqueous fluid containing both organic and inorganic constituents ; and in the performance of this function they are endowed with the power of selection. As the process continues, this fluid passes through the stronger parts of the root to the stem, which it mounts by the softer external part, called *alburnum* or *sap-wood.* When the plant is in full vegetation there is a constant current or circulation of the fluid from the roots, where it is absorbed, to the leaves, where it is altered in character. In its ascent from the root to the leaves, the fluid consists of little more than a thin watery solution of the inorganic constituents, with some mucilaginous and saccharine matters dissolved from the plant in its progress, and is called *crude sap.* When this sap has arrived at the leaves or other green parts of the plant, it is exposed to the action of new agencies, namely, the atmosphere, heat, and light ; and it undergoes an important change.—1. In losing a large portion of its water by *transpiration* or *exhalation* ; 2. In the absorption and decomposition of carbonic acid gas, by what is called *respiration*, and by which the carbon is provided to the plant ; and 3. In the formation of certain organic products and secretions (including medicinal principles) by the process of *assimilation.* After these changes have taken place the fluid is called *elaborated sap.* When the sap is duly elaborated, it commences a downward course, along the *inner bark* or *cambium*, towards the root, adding new structures to the plant, and depositing its secretions in its course.

Such is a mere outline of the life of a dicotyledonous plant; but it is sufficient to suggest to us the modifications which medicinal plants may undergo according to the circumstances of their growth, namely,

2. *How the plant may be affected by a change in its circumstances.* —*a.* There are certain constituents of a plant that are essential to its existence, without which it cannot thrive, and the absence of which is marked by the unhealthy appearance of the plant. There are other constituents that are always present under favourable circumstances, but which may be entirely absent without causing any

external indication of the deficiency. Amongst the latter are medicinal principles. A plant which possesses medicinal properties when grown in one locality, may grow even more luxuriantly in another, and yet be deprived of its medicinal virtues—a change only to be recognised by analysis or by experimental application.

b. Many fruits and vegetables esteemed in our time have been gained by cultivation from repulsive ancestors, and saccharine and amylaceous principles have been developed in them, to the exclusion of their former sour and bitter ingredients. Hence fruits and vegetables are rendered more agreeable and nutrient by cultivation. But the medicinal principles of plants are often characterized by a bitter or other disagreeable taste, and sometimes by an offensive odour; and if the effect of cultivation be to alter these characters, it is probable that the medicinal virtue of the plant will also be modified to a corresponding degree. Hence, by analogy, we might infer that cultivated plants may be inferior to wild plants for medicinal purposes. But since long experience has taught the fruit and vegetable gardener how to improve his produce, it is probable that continued observation by our intelligent medicine cultivators will enable them to overcome whatever obstacles at present beset their path, to which end they will be stimulated by the measure of success that has already attended their meritorious efforts.

c. The soil in which medicinal plants are cultivated must contain the constituents essential to the building up of the plant and to the formation of its active medicinal principles. The absent constituents are to be supplied by manures, an operation demanding considerable scientific and practical acquirements, and great caution. For it is not only the deficiency of certain ingredients in the soil that interferes with the virtue of medicinal plants, the selective power of the plant itself also exercises an important influence. A medicine may be inert because of the plant having been deprived of some of its important constituents ; but the loss of activity may also result from the plant having been too richly supplied with a certain kind of aliment which it selected in great abundance, to the neglect or exclusion of other essentials.

d. The climate must be suited to the habits of the plant, a circumstance over which the cultivator has no control. The two more important elements are temperature and light, which cannot be supplied together by artificial means. Exotics may be placed in hot-houses whose temperature is equal to that of their native land ; but the quantity and intensity of the light, and the corresponding solar

influence of tropical regions, can never be reproduced in this country, and it is to them that the elaboration of the sap and the simultaneous formation of active secretions are chiefly due.

e. The age of the plant and the season at which it is collected affect its active properties. Medicinal plants are to be gathered when they are in full vigour. Until perennial plants have attained a certain age they have not laid up a sufficient store of active principles to make it worth while to destroy them; they are allowed to come to full vigour, but not to pass on to decay. Annuals are collected also in the vigour of life. The part of the plant to be used, as the leaf, the root, the bark, the fruit, the seed, determines the time of collection.

Roots may be gathered either in autumn or spring, before the development of the leaf, or after the ripening of the fruit. According to Dr Houlton, they should be taken up at the time that their leaves die, when they abound with the proper secretions of the plant. To this rule he allows no exception, but applies it equally to the roots of trees, shrubs, herbs, root-stocks, bulbs, cormi, and tubers. Biennial roots are to be gathered in their first year, as it is too late to collect them after the fall of the leaf in the second year, for by that time they are either dried up or decayed. Roots that are to be preserved should be dried immediately after they are collected. Large roots, especially the more juicy, dry spontaneously more readily in their entire state than when sliced, and their juices are then not exposed to the influence of the atmosphere, which is a matter of some importance. But many roots are dried in slices; and *bulbs* are first stripped of their outer layers, and then cut into transverse or longitudinal slices before drying.

Leaves are most vigorous, and contain their active principles in greatest force when the process of flowering is somewhat advanced, but before it is fully accomplished. As a rule, they should be collected between the expanding of the flower and the ripening of the fruit. The leaves of *Aconitum Napellus* cause tingling and numbness in the lips, cheeks, and tongue, from their first appearance till the seeds begin to form; afterwards this property is lost, although the leaves still remain vigorous. Leaves may be either stripped from or dried with their stalks. When dried rapidly at 130° to 140° in a dark drying-room, until they crumble in the hand, they preserve their green colour and medicinal properties. Afterwards they are to be kept in closely-covered opaque jars, and powdered in quantities as required. The juices of leaves are less liable to deterioration

by being inspissated in their own cells than they are by being formed into extracts, however carefully the process may be conducted. The drying of leaves is of no small importance, as upon the careful performance of this operation depends greatly their medicinal activity. It is important to preserve the colour both of leaves and flowers, for when the colouring matters are lost, other valuable principles go with them. The leaves of Digitalis, Belladonna, Stramonium, and other plants, contain less of their peculiar active principles when badly than when carefully dried.

Flowers are to be collected when they are partly or full blown. Some are collected soon after expansion has begun, and the *Rosa Gallica* is gathered before the bud is evolved, when the colouring and astringent principles are more abundant. Flowers are gathered at different times of day. If they are intended for immediate use, they may be collected either in the morning or in the evening; but if they are to be dried, they should not be taken when they are wet with dew or rain. When flowers are used for the sake of their odour, which arises from the presence of a volatile oil, they should not be gathered after they have been long exposed to the sun. The heat of the sun exhausts the odoriferous principle more rapidly than the plant can supply it, and in the heat of the day the odour of the plant is less powerful. They are suspended in bundles for drying, and are sometimes covered with paper to preserve them from the effect of light. Flowers should be dried promptly, but very carefully, and afterwards be preserved in well-closed opaque vessels.

Fruits are collected when nearly or quite ripe. If they are to be used immediately, they may be left until they are fully matured, but not until they have lost their plumpness, especially if the juices are prone to rapid change. If they are to be preserved in their fresh state, they must be taken a little earlier.

Seeds are taken when quite ripe, at the dehiscence of capsular fruits, and at the maturity of the pericarp in pulpy fruits. Seeds enclosed in *shells* should be preserved in them until required for use. Seeds require but little drying.

Woods are denser—and are said to yield more medicinal principles—in winter than at any other season. The wood of trees becomes denser if the bark be removed whilst they are standing, since the juices, then no longer finding their means of descent, become consolidated in the wood. A decorticated tree affords wood doubly rich in medicinal principles, not only because of its extra density, but also because it is found that trees deprived of

their barks whilst standing become more quickly the prey of insects; and as these do not remove the active parts, weight for weight, such wood is more valuable than that procured in the ordinary way.

Barks are to be gathered when they can be most readily separated from the tree, either before or after the full development of vegetation, and not when the reproductive process is in activity. Spring is generally the most suitable time ; and, as an example, oak bark contains more tannic acid at that period than at any other season.

Desiccation and Preservation of Medicinal Plants generally.—Medicinal substances derived from the vegetable kingdom are prone to deterioration by keeping. They should be frequently examined, and all simple indigenous herbaceous plants should be renewed annually. If the plants could be obtained in the recent state at all seasons, there would be no necessity for preserving them ; but as this is not so, a store is to be laid up for use until a fresh supply can be obtained at the hands of nature. The first process in the art of preserving plants is to deprive them of their water of vegetation ; and this is to be done with the utmost care, so that as little as possible of their fugitive principles may be lost. Desiccation is conducted in an appropriate room, usually a loft at the top of the house, constructed in such a manner that a free current of air may pass through it, whilst neither the sun's rays, nor rain, nor even much daylight, can find access. Drying should be done as promptly as the means employed will allow ; when it is conducted too slowly prejudicial changes are apt to take place in the juices. The water is to be abstracted, not driven, from the plants ; and for this purpose three qualities are necessary to the atmosphere that is to absorb the moisture—*a certain temperature, dryness, and movement.* Warm air will take up more moisture than an equal volume at a lower temperature ; and if the air be kept in constant transit through the room—in at one end and out at the other—the drying may soon be accomplished. The current of air should be directed in such a manner that it may approach from the warm or sunny side of the building, where it will derive additional warmth from the venetians heated outside by the sun. When artificial heat is used, great care is to be observed that the temperature be not carried too high, nor raised too suddenly, otherwise the plants may be rendered useless by being parboiled in their water of vegetation. The substances to be dried are spread in thin layers, or hung in garlands, and frequently turned. When the drying is finished, they are left inflexible and brittle ; but after a time they recover a certain amount of water

from the atmosphere, and become more flexible. When the quantity to be dried is not great, boxes of suitable construction are used instead of a large apartment. In some cases, the less delicate plants are simply spread out in the open air in a shady place, protected only from the sun. When the medicinal property depends upon the presence of a volatile oil, desiccation should be conducted at as low a temperature as is consistent with the evaporation of the water.

3. *Examples quoted as evidences of the influence of such change of circumstances.*—The following have been mentioned by various writers :—Cinchonas that are grown on cold and exposed mountain sides are richer in alkaloids than others that are grown in close and unventilated valleys. Colchicum, which at all seasons in this country contains poisonous principles, has been eaten with impunity in other countries in autumn, according to Krapf, Kraterhvill, and Haller ; and Orfila states that he has frequently, in the month of June, given two or three corms to dogs without producing any peculiar results, and hence he supposed that the deleterious properties are modified by climate and season. Buchner held that the plant is most energetic in autumn, when the flowering stem is rising. Professor Christison believes it to be very energetic in spring, when it is watery, more membranous, shrivels much in drying, and is very bitter. *Opium*, *Senna*, *Mentha*, *Digitalis*, *Agaricus piperatus*, *Amanita muscaria*, *Myrospermum*, and many others, have been quoted as examples of the influence of climate either in modifying the sensible characters or affecting the nature of certain active poisonous principles in plants. The Indian variety of hemp, when cultivated in this country, grows well, attaining a height of ten feet or more ; but it no longer possesses its narcotic properties, nor the resinous covering of its leaves. Haller states that Valerian, gathered in low situations from humid soil, is much less efficacious than that grown on the heights ; and in almost all cases where the same plant grows both in high and low situations, those of the higher locality will be found to be more prominent in their characteristic features. The *Solanaceæ* and the *Cruciferæ* thrive best in the vicinity of animal life, and are far less vigorous when grown in an arid soil. Some of the *Umbelliferæ*, which are aromatic when grown in a dry soil, acquire poisonous qualities in a humid locality. Dr Christison mentions that *Cicuta virosa* and *Œnanthe crocata*, both umbelliferous plants, which are generally poisonous in England, are harmless when gathered in native localities near Edinburgh. Almost all

powerfully odoriferous plants lose their odour in a sandy soil. Assafœtida is modified both in its botanical characters and medicinal properties by change of soil. Russian rhubarb is said to contain a much larger proportion of inorganic matter than East Indian or English rhubarb. Some plants thrive best in a dry and porous, some in a gypseous, some in a nitrogenous soil. The oil obtained from plants grown at Mitcham varies both in quantity and quality with the season and soil. Two adjoining acres seldom yield alike. This fact is, perhaps, more remarkable in the case of *Peppermint* than of any other plant grown there. Of two crops of this plant growing close to each other, that which is most luxuriant in appearance may yield the smallest quantity of oil; and between the oil obtained from plants grown at Mitcham and those grown at Carshalton, although they are adjoining parishes, there is a great difference both in quality and quantity—a fact due to soil alone, since the care bestowed on the cultivation is alike in both places.

Some medicinal plants are improved by cultivation, but hitherto wild specimens have been generally preferred. The flower of the Chamomile, like that of many other plants, is doubled by cultivation, and its medicinal value thereby greatly deteriorated. Wormwood loses much of its bitterness by cultivation. It is generally stated that by cultivation, which renders its growth more luxuriant, the medicinal virtues of Aconite are impaired. Geiger stated that acrid varieties of Monkshood lose their acridity by cultivation; but Dr Christison affirms that this is not the case with the variety of *Aconitum Napellus* cultivated in the gardens and shrubberies of Scotland.

Plants vary considerably, both in physical qualities and in chemical composition, according to their ages. Young plants contain much water with mucilaginous principles, and at this stage of their existence can be used only to a very limited extent in medicine. At a later period their juices are more elaborated and their secretions more complex. The different parts of plants vary also according to the age and condition of the plant. Barks are useless when too young, from not having had the necessary medicinal principles stored in them; and when too old their extractive matters become impaired, and their saline ingredients are exhausted by the rain percolating through their numerous fissures. Roots lose their succulent and flexible state, and become woody with age. In cases where the root bark is used, it is desirable that the roots should have attained a certain age; but where the substance of the

root is used, it should be gathered while still flexible and containing duly elaborated juices. The narcotic principle of the poppy is not met with until the petals have fallen. The fruit of pimento changes the character of its flavour when allowed to attain maturity. Negroes feed upon the young shoots of a species of *Apocynum* without suffering any inconvenience, although, when fully developed, the plant contains poisonous and drastic principles. The clove is the unexpanded flower of *Caryophyllus aromaticus;* if it be allowed to expand, its peculiar taste and odour pass away, and they are not developed in the fruit. *Colchicum autumnale*, *Conium maculatum*, *Hyoscyamus niger*, and others, afford examples of the effect of age in modifying the medicinal properties of plants.

The active principles of Medicines derived from the Vegetable Kingdom.—We see, then, that there are several causes by which the medicinal properties of plants may be modified ; and as these changes are effected chiefly through their *active principles*, it will be well for us to take a general view of the organic constituents concerned in the actions of medicines. When we regard the numerous substances of medicinal value that are formed during the growth of vegetables, remarking that, whilst they are frequently almost identical in constitution, yet they differ widely in their action when introduced into the human system, we see how much the physician is dependent upon the skill and accuracy of the pharmaceutical chemist. It is to organic chemistry that we owe the many elegant and powerful remedies of late years introduced into practice.

The organic proximate principles of which plants are composed, when resolved into their ultimate elements, are found to consist of varying combinations of Carbon, Hydrogen, Nitrogen, Oxygen, Phosphorus, and Sulphur ; and according to the number of these elements, the number of atoms of each contained in the proximate principle, and the method of their arrangement, will be the nature and potency of the medicine thus derived. Some of the proximate principles of plants are exceedingly powerful, so as, in certain cases, to be poisonous in very small quantity ; whilst others are nutrient, and supply the necessities of the animal economy. Of the former class, we have the alkaloids, neutral organic principles, organic acids, volatile or essential oils, resins, &c. ; of the latter class, we have fixed oils and fats, starch, sugar, gum, and cellulose, besides the proteic or albuminoid compounds. We have space only for a word or two on each of these groups.

Alkaloids are, as the name implies, substances *like alkalies* (*alkali*

and εἶδος, likeness) although they exhibit the properties of alkalies only to a limited extent. They are sometimes called *organic* or *vegetable* alkalies, the former because of their requiring a vital action to constitute them, and the latter with reference to their vegetable origin. The alkaloids are generally the most potent of the organic principles. They are for the most part solid and crystalline, but some are volatile. They are but sparingly soluble in water, more so in alcohol, and readily soluble in most of the dilute acids, and in ether and chloroform. The greater number are capable of restoring the blue colour to reddened litmus, and of forming with acids definite salts which are crystalline. Most of the alkaloids are quaternary compounds, consisting of C, H, N, O, in different proportions, but some few are ternary, and contain only C, H, N. Nitrogen is invariably one of their constituents. Various plants of the same natural family may yield a common alkaloid; but, on the other hand, many plants of a common family may each contain a distinct alkaloid, whilst in some instances, as in opium, several alkaloids are met with in a single plant. The alkaloids are not met with in a free state in plants, but usually in combination with peculiar vegetable acids. All poisonous plants are believed to contain either an alkaloid or a neutral characteristic principle. It may be useful to remember that *most* of the alkaloids can be precipitated from solution, whether they be uncombined or in the form of salts, by *tannic acid*, and that, therefore, substances containing this astringent principle may be used generally as antidotes. A little confusion sometimes arises between the nomenclature of the alkaloids and of the neutral principles. The names of both are usually derived either from some peculiar property of the principle itself or from the name of the plant from which the principle is first obtained. By some writers the last syllable is written indiscriminately *in* or *ia;* whilst others adopt the general rule of terminating the vegetable or organic alkaloids with *ia* and the neutral vegetable principles with *in*. Thus we have the alkaloids *Aconitia, Delphinia, Quinia, Morphia, Strychnia,* &c., and the neutral organic principles, *Meconin, Guaiacin, Cusparin, Colocynthin, Elaterin,* &c.

Neutral Organic Principles.—These principles are usually ternary compounds, consisting of C, H, and O. Several of them are medicinal agents, whilst others appear to be almost inert. They are more or less bitter in taste, and when boiled with dilute sulphuric acid, they yield glucose or grape sugar, and are hence termed *Glucosides.*

Organic Acids.—Vegetable organic acids exist as salts in the juices of plants in combination with potash, soda, lime, or an alkaloid; but they are occasionally met with in the free state. They are generally solid and colourless, and mostly crystalline; they are soluble in water and alcohol, and in combination with bases form definite crystalline salts. Some volatilize readily when moderately heated in air, and all are decomposed when heated in closed vessels. Some of the acids, as tannic, are widely diffused through the vegetable kingdom, whilst others, as meconic, are restricted to a single family. Some of the vegetable acids are *educts*, others are both *educts* and *products;* or, in other words, some exist naturally as proximate principles of the plant, and can be separated by simple processes, whilst others, although in the same manner existing naturally in plants, may also be produced artificially from other organic materials. All the acids contain oxygen except *hydrocyanic*, which is the only one containing nitrogen.

Volatile or Essential Oils.—These oils are largely used in medicine for a variety of purposes besides that of imparting an agreeable taste and odour to offensive drugs. They are found most abundantly in the leaves and flowers of plants, from which they are obtained by distillation with water, or, in some instances, by expression from the cellular structure. The delicate and fugitive character of some of these oils demands most careful attention to the process of distillation. Volatile oils, when quite pure, are believed to be invariably colourless, though some have never yet been obtained in that state; and all, when exposed to air and light, readily assume a certain colour. Their odour is similar to that of the plants yielding them, but they are seldom agreeable in the concentrated form. The readiest way to ascertain the true odour is to rub a drop on the hand, and then breathe upon it, or allow a little to be diffused through the air of an apartment. The essential oils, owing to their value, are greatly subjected to adulteration. By careful fractional distillation they may be separated into two parts, called *Elæoptene* and *Stearoptene* (ἔλαιον, *oil*, στέαρ, *fat*, and πτηνός, *volatile*) which have different specific gravities. The former of these is frequently a *hydrocarbon*, and the latter an *oxyhydrocarbon*, which in some instances is concrete, and frequently has the composition of ordinary camphor. The volatile oils may be chemically defined as—1. *Hydrocarbons* or *Camphenes*, constituted of C and H. Of this group, oil of turpentine may be regarded as the type, with which, although their sensible properties vary considerably, the oils of lemon, ber-

gamot, orange, juniper, and others are isomeric. 2. *Oxyhydrocarbons*, containing, in addition to C and H, oxygen, which may exist either in both the Elœoptene and Stearoptene, or in the latter only. These oxygenated essential oils are the most soluble of the volatile oils in alcohol and water, and are extensively used in the form of medicated waters. This class includes also camphor and its modifications. 3. *Sulphuretted* and *Nitrogenated Oils.*—Many of the plants containing these oils are used for culinary purposes, as horse-radish and garlic. Except assafœtida, sagapenum, and garlic, all the oils of this class are derived from the *Cruciferæ.* There are a few volatile oils which contain nitrogen in the form of prussic acid; they are chiefly derived from the sub-order *Amygdalæ* of the *Rosaceæ.*

Resins are widely diffused through the vegetable kingdom, and are obtained either by spontaneous exudation, or by incisions made into the bark or wood of trees and shrubs. On exposure to the atmosphere the essential oil with which they are united either evaporates or solidifies by oxidation, and the resin assumes its hardened form. They are usually constituted of different resinous principles, which are capable of separation. The resins are dry, brittle, of varying taste, odour, and colour, all of which characters are probably due to the presence of ingredients not truly resinous; they are readily fusible, and very combustile, and become electric by friction. They are insoluble in water, more soluble in hot than in cold alcohol, and they are deposited from their solution on the addition of water, the water assuming a milky appearance. Most of them are soluble in ether, and in the fixed and volatile oils. Being insoluble in water, the resins cannot be prescribed with that alone, but may be made into *emulsions* by the addition of a little oil and gum, or yolk of egg. Resin of scammony may be given in milk or almond emulsion. In their medicinal effects the resins usually, but not invariably, resemble the essential oils to which they correspond. When they retain a considerable quantity of essential oil, they preserve a semi-liquid form, and are called *oleo-resins* or *terebinthinates;* but when hard and brittle, from the loss of the oil, they are *resins proper.* When *benzoic* or *cinnamic* acid enters into their constitution they are called *balsams,* and the admixture of gum separates them into the class of *gum-resins.*

Extractive.—Formerly, when plants possessed medicinal properties which could not be attributed to any recognised proximate principle, their actions were said to be due to the *extractive prin-*

ciple—a term applied to a substance widely disseminated through the vegetable kingdom. The substance thus named, but even now ill-defined, gradually diminished in importance, as more complete analysis showed the presence of definite proximate principles, to which the actions of the plant as a medicine became referable. Formerly the extractive principle was presumed to be the common basis of all extracts, but subsequent investigations proved that it was not a simple principle, but a heterogeneous mixture of matters peculiar to individual plants. It is intimately associated with, but does not constitute, the active principle of the plant. It is recognised by its amorphous condition and brownish colour, by its distinct but variable taste, its solubility in water and in weak alcohol, its insolubility in absolute alcohol and in ether, and by the rapid change which it undergoes when exposed to the air—all of which characters, however, are more or less modified according to the source of the extractive. Seeing that this substance forms a part of very many medicinal plants, it must enter also into many pharmaceutical preparations, from which, however, may be excluded the following,—namely, solutions made with strong alcohol, ether, and oils, because it is insoluble in these menstrua; and preparations made by distillation, because it is not volatile.

Fixed Oils and Fats.—These ternary non-nitrogenised organic principles, derived from the vegetable and animal kingdoms, are largely used, both as articles of diet and as medicines. When taken internally, they operate as nutrients, alteratives, demulcents, or cathartics; whilst externally, they are applied as emollients, and are largely used also as vehicles for more powerful medicines. They are subject to adulterations—the fine or superior varieties with the inferior qualities.

Saccharine Principles.—These substances, of ternary composition, exist both in vegetables and animals. They are characterised by a sweet taste, solubility in water, and, under certain circumstances, by their decomposition into alcohol and carbonic acid. The chief varieties of sugar are: cane sugar (sucrose), grape sugar (glucose), fruit sugar (fructose), and sugar of milk (lactose). In a variety of forms, sugar is administered both medicinally, and as an article of diet.

Starch.—This ternary compound exists largely in plants, especially in the seeds and in the underground tubers and bulbous roots. There are many varieties, of which the chief are wheat-starch, potato-starch, rice-starch, arrowroot, sago, and tapioca. Starch is

convertible into dextrine and grape-sugar. It is a valuable test for the presence of iodine, with which it forms a characteristic blue compound.

Gum.—There are several varieties of this ternary principle derivable from the vegetable kingdom, either by spontaneous exudation or by incisions into the barks of trees. The varieties are not readily distinguished; they have been classed into soluble gums, and those which swell up in cold water; of the former of which *Arabine* is the type, and of the latter *Tragacanthine* or *Bassorine.*

Pectose, Pectin, Pectic Acid, Vegetable Jelly.—*Pectose* exists in the succulent roots and acidulous fruits of many plants, and is converted by the organic acids, and by heat and light, into a soluble gelatinous substance called *pectin, parapectin, pectic acid,* &c. Pectin is formed during the ripening of the fruits, and gives the gelatinous character to the juices of currants, raspberries, &c., and also to the juices of some medicinal roots, such as gentian, dandelion, &c.

Cellulose, Lignin, Woody Fibre.—*Cellulose* or *cellular matter* is an organised substance, without colour, taste, or smell, translucent when freed from foreign matter, and medicinally inert, occupying the cell walls of plants, and forming the pure base of woody fibre. It is nearly insoluble, and by the aid of sulphuric acid is convertible into dextrine. It is as much as possible excluded from nearly all pharmaceutical preparations used internally, but lignin is used externally in the form of cotton and lint, and enters into the compounds *pyroxylin* (gun-cotton) and *collodion.*

Proteic or Albuminoid Substances.—Besides the ternary proximate principles already enumerated, there are in all plants and animals certain neutral nitrogenous compounds, consisting of C, H, O, and N, for the most part in combination with sulphur and phosphorus. Mulder was the first to point out the general resemblance between these bodies, as existing in the vegetable kingdom, where they are represented by *gluten, albumen, casein,* or *legumin,* and in the animal kingdom, where they are met with as *fibrin, albumen, casein,* and *gelatin,* their constitution being almost identical in both kingdoms. With the exception of *gelatin,* these substances are said to be derivatives from a common principle, *protein,* which, according to Mulder, consists of $C_{18}H_{25}N_4O$, but according to Liebig, and others, of $C_{24}H_{36}N_6O_7$; and it has been supposed that this principle, in combination with various proportions of sulphur and phosphorus, yields

the above-mentioned, and hence so-called *proteic compounds*. These principles, according to the modern chemical theory, form what are called the *flesh-forming* articles of diet, as distinguished from the non-nitrogenous ternary compounds, starch, sugar, and gum, which are said to be merely *heat-producing* substances. Although their composition is well understood, yet no definite chemical formulæ have been constructed to represent their constitution; but it is known that they readily undergo decomposition when exposed to moisture and a certain temperature, being converted into water, ammonia, carbonic acid, and other inorganic compounds. When these principles are in a putrefying condition, they act as ferments to many organic substances, whereby a large number of the permanent pharmaceutical preparations would be destroyed were not these protein compounds removed by coagulation or precipitation.

Pharmaceutical Operations.

As a general rule, medicines are not obtained from nature in a condition fitted for immediate use: almost all medicinal substances, except mineral waters as a class, require to undergo certain processes to prepare them for administration. The operations performed upon them may be either mechanical or chemical.

The following—in alphabetical order—are the principal pharmaceutical processes, but including only such as are not commonly treated of in courses of lectures on chemistry:—

Clarification.—The removal of substances which impair the transparency of liquids. Heat is commonly employed for this purpose, as in the clarification of honey: the honey is melted in a water-bath, whereby the impurities are set at liberty, and may be either removed by subsidence, or by skimming, according to their density, or by filtration. But clarification is more commonly effected by means of albumen with the subsequent application of heat. White of egg is used for this purpose: it is first mixed with a little water and then added to the *cold* liquid, care being taken to diffuse it equally through the liquid before the application of heat. The temperature of the mixture is then gradually raised until the albumen coagulates, in doing which it seizes the impurities suspended in the liquid, and either floats or subsides with them according to their combined density, as compared with that of the fluid.

Comminution.—The process by which vegetable substances are broken into coarse pieces, as in the preparation of infusions and

decoctions. This operation is effected by means of the *cutting, slicing, rolling,* or *cradle-knife,* when the substance is easily cut; but if it be dense and hard, as wood, roots, barks, &c., as a preparatory operation to powdering, the *chopping-trough* is more suitable.

Contusion.—The process for powdering hard and tough substances. It is effected by means of the pestle and mortar, handworked if the quantity to be operated upon be small, but if large, the pestle is worked by machinery.

Crushing is an operation performed upon recent herbs to obtain their juices for various purposes. This process is sometimes effected by means of a pestle and mortar; but when the substance is in large quantity, it can only be accomplished by the aid of a *drug* or *pugging-mill.*

Crystallization.—Many medicinal substances are directed to be kept in the crystalline form. It is the state in which they are least subject to adulteration; and the crystal is one of the chief characters by which we recognise them. Crystals are beautifully regular mathematical forms assumed by certain substances in their passage from a gaseous or liquid to a solid state. They are sometimes obtained from volatile substances by sublimation or by fusion; but far more commonly either by the gradual evaporation of the fluid in which the substances are dissolved, or by some chemical interference forming a new substance which the solvent is no longer capable of retaining. The hot and saturated solution from which crystals are generally obtained is first strained, and then "set aside to cool and crystallize." The finer crystals are obtained by the very slow, gradual, and uniform evaporation of a thoroughly strained solvent; and they are still finer if the concentration previous to the setting aside has not been carried too far. If the previous concentration is continued until a pellicle forms on the surface of the solution, the subsequent crystallization is effected more hastily, and the crystals are seldom distinct. The liquid that remains after the formation of the crystals is called the *Mother Liquor,* which still contains some of the substance in a concentrated form, in combination with any impurities that may have escaped the filter. According to the value of the substance, the mother liquor is either rejected or preserved for use in future operations. Some substances which crystallize with difficulty are obtained by *granulation.* This is done by constantly stirring the solution during its evaporation. Most crystals contain a definite quantity of solidified water, called

water of crystallization, or, when it replaces a base, *water chemically combined.* Salts are called *deliquescent* when they absorb water from the atmosphere; *efflorescent* when they part with their water spontaneously; and *permanent* when they neither absorb nor give off water. Compounds containing water in definite proportions by weight are called *hydrates* (not to be counfounded with *hydrides*, in which hydrogen is a constituent). Compounds which do not contain water, or from which it has been driven off by artificial processes, are called *anhydrates.* For the *systems* and other particulars of crystals, I must refer the student to works on *Crystallography.*

Decantation is the separation of a supernatant liquid from a precipitate or sediment collected at the bottom of the vessel. In this operation two things are to be guarded against—spilling the liquid and disturbing the deposit. The following means are employed to facilitate this simple-looking but often difficult operation:—1. The guiding rod; 2. Greasing the rim of the vessel from which the fluid is to be poured; 3. The syphon; 4. The pipette; 5. The syringe.

Decoction.—See Decocta amongst galenical preparations, and also the following article—*Digestion.*

Digestion is the process for dissolving a medicinal substance in a menstruum by the aid of sustained heat. The terms Maceration, Digestion, and Infusion are often used indiscriminately. They have the following relative signification:—*Maceration* is when a solution is made with the menstruum at the ordinary temperature of the atmosphere (*cold infusion*); *Infusion* (*except cold infusions*), is when a solution is made with the menstruum originally at the boiling-point, but allowed to cool gradually; *Digestion* is when a solution is made with the menstruum a little below the boiling-point, but sustained at that temperature for a prescribed time—a process analogous to that of *simmering. Decoction* differs from the former processes in this, that the menstruum is kept at the *boiling-point* for a given time, and is then allowed to cool gradually.

Displacement or *Percolation* is a process which has been gradually superseding that of *maceration.* The difference between the two processes is simply this, that in *marceration* the substance from which the desired ingredients are to be dissolved lies in the menstruum for a certain time; whereas in the process of *percolation or displacement*, it is suspended in the course of the menstruum which abstracts the desired ingredients as it filters through it. *Percolation* (*percolo*, to strain through) signifies nothing more than

filtering in such a manner that all the menstruum shall come in contact with the whole of the contents of the filter; the object being not to remove impurities from the liquid, but to obtain a medicated filtrate. The term *displacement* relates to the fact that the fluid with which the substance is saturated can be displaced, under favourable circumstances, either by the addition of more of the same, or of another suitable fluid. A variety of instruments are used for this process, the rationale of which is this:—The substance to be operated upon is first reduced to a convenient state of division, and is then placed in a cylindrical vessel of such proportions that the height of the column shall be more considerable than the breadth, in order that the menstruum, as it passes through, may come into contact with as many layers as possible. Within the cylinder is a perforated diaphragm, which allows the passage of the menstruum after it has percolated the substance; but which, whilst it serves as a support to the latter, prevents its escape at the bottom of the cylinder. The lower part of the cylinder is contracted, so as to be under the control of a tap or a cork, and is adapted to a vessel suitable to receive the filtrate. The menstruum is then poured in certain quantities upon the substance in the cylinder, and so soon as it begins to drop into the receiver below, the process is either checked for a little while by a tap or cork at the lower end of the cylinder, or, if not, that which passes through first is sometimes returned to the cylinder to perform its work a second time. It is generally considered better to moisten the substance previous to packing it in the cylinder or percolator. Unless the process be well conducted, the result will not be satisfactory. The chief points to be regarded, and which I cannot here dwell upon, are—1. The state of division of the substance which varies for different substances; 2. The degree of firmness with which it is packed; 3. The uniform permeation of the menstruum—care being taken to avoid its passage by *channels* or *interstices*. See *Tincturæ.*

Distillation.—The object of this process is to separate volatile from fixed ingredients in solution. It is analogous to the *sublimation* of dry substances. It differs from evaporation in its object, that of distillation being to preserve the volatile part, whilst the intention of evaporation is to dissipate it. The process is effected by the aid of heat and cold. The solution is heated to a temperature sufficient to convert the required part of it into vapour, which is carried to a separate part of the apparatus, to be again restored to its fluid form by the influence of cold. The temperature at which the

process is carried out will depend upon the volatility and inflammability of the liquid to be operated upon. Sometimes a substance may be separated into several parts by a gradual increase of temperature, the part which is volatilizable at the lowest temperature passing over first (this is termed *Fractional Distillation*). Many of the officinal *waters*, *spirits*, &c., are prepared by distillation.

Destructive Distillation is a process conducted apart from atmospheric influence, whereby organic bodies, being subjected to a high temperature, lose their original form, and yield new products.

Elutriation is a process by which powders may be separated into quantities of different degrees of fineness. The powders to be operated upon are suspended in water—which must neither dissolve nor act chemically upon them—are carefully diffused through it, and the whole is allowed to stand for a little while. During this period of repose the heaviest particles sink to the bottom ; the fluid is then decanted, leaving the coarser powder behind, which, when dried, forms one of the desired qualities. By repeating this process, each time allowing a longer period of repose, the powder may be reduced to the last degree of fineness. In this way also impurities, differing in density from the true powder, may be removed.

Evaporation.—Vaporisation is the conversion of fluid substances into vapour. It may be effected at various temperatures, according to circumstances. If the atmospheric pressure be removed, as when evaporation takes place under the bell of an air-pump, a very low temperature is required ; and from this the process may be conducted at any temperature up to the boiling-point. Evaporation is used in the manufacture of many of the galenical preparations, but its most common application is to the preparation of extracts, under which it will be mentioned again.

Filtration.—This is a process for the separation of solid particles from the fluids in which they are held in suspension. For this purpose the liquids are passed through media of different degrees of porosity, according to the fineness of the particles which are to be kept back by their intervention. These media, called *Filters*, are made of different substances, and are constructed and supported in various ways to suit circumstances. In some cases, organic materials are used, such as *woollen cloth*, *flannel*, *linen*, *calico*, and different qualities of *paper ;* in others, inorganic materials are employed, such as *sand*, *powdered glass*, *powdered rock crystal*, *prepared asbestos*, *charcoal*, *&c.* *Straining* differs from *filtering* only in being conducted with less care and greater rapidity ; it is used when the entire

separation of the solid particles is not essential. The object of filtration may be either to purify a liquid, discarding the solids; or it may be to obtain the solid contents, the liquid being unimportant; or it may be to separate them and preserve both. When the solid substance is a powder which, by its density, sinks in the liquid, it is called a *precipitate*, and the liquid separated from it by filtration is termed the *filtrate.*

Granulation.—Some of the metals, as zinc, tin, and others, are reduced to different states of division by this process. The operation varies according to the properties of the metal to be divided, and the condition required. Zinc may be melted and poured into water, by which it is coarsely divided; or it may be melted, and in this state be rubbed in an iron mortar until it is solidified, by which process it will be obtained in finer particles. Tin may be granulated by pouring it, in the molten state, into a strong wooden box, closing the lid firmly, and shaking it until it becomes solid. For the granulation of powders—see *Powders.*

Infusion.—See Infusa amongst galenical preparations; see also under *Digestion.*

Levigation.—The process of rubbing substances between two hard surfaces to reduce them to very fine powder. The substance to be operated upon is first formed into a paste by means of water, which constitutes the only difference between this process and *trituration*, for which no liquid is required. Substances that are powdered by levigation are sometimes formed into little conical masses, to facilitate the drying, of which we have an example in levigated chalk.

Lixiviation is the process used for the separation of the soluble from the insoluble parts of certain bodies, as in the preparation of soapmaker's ley. It is a form of the process of solution by percolation or displacement.

Maceration is the process for dissolving medicinal substances in liquids at the ordinary temperature of the atmosphere. The substance to be operated upon is previously prepared by comminution or coarse powdering, and the solvent, called the *menstruum*, is then poured over it. In this condition the ingredients are allowed to remain for a period varying from half-an-hour to several days, according to circumstances. Substances containing volatile principles that would be driven off by heat, and others which would yield undesirable ingredients to hot liquids, are prepared by maceration. The cold infusions, and most of the tinctures, are so prepared. Mace-

ration is somewhat superseded by displacement or percolation. *See Digestion.*

Porphyrization is a form of *trituration*, the substance being reduced to fine powder by rubbing it between a porphyry slab and muller. The substance to be operated upon is first coarsely powdered, and is next made into a moist, tenacious paste, or *magma*, by the addition of water, if that liquid does not act injuriously upon it. The muller is then worked in a regular curvilinear manner over thin layers of the mass. This method is not much used.

Precipitation is the process by which a solid substance may be separated from a fluid in which it was previously dissolved, the solid thus separated being either in the form of crystals, amorphous powder, or magma (a moist, tenacious mass). The substance may either fall to the bottom, be diffused through the liquid, or float on its surface ; but more commonly, as the name implies, it is thrown down. The substance is called a *Precipitate*, and the agent which produces it is called the *Precipitant.* Precipitation may be caused by chemical or other changes which affect solubility. When two soluble chemical substances, having an affinity for each other, are brought together in solution, if between them they contain the elements of an insoluble compound, it will be formed and precipitated. This it is important to remember in the construction of magistral formulæ. Precipitation may also be caused by physically interfering with the solvent powers of the liquid ; thus, there are certain alcoholic solutions which throw down their contents on the addition of water. Several of the tinctures are thus affected.

Pulverization.—The powdering of drugs is chiefly executed by wholesale drug-grinders, whose *mills* are adapted to perform the operation in a suitable manner, and upon quantities equal to the enormous demand. In smaller quantities, drugs may be reduced to a state of division suited to different circumstances, by any of the following processes :—*Contusion, trituration, porphyrization,* and *levigation.* All drugs before they are sent to the mill should be *garbled*—that is, all adulterations and inferior pieces should be rejected, and none but the best specimens should be allowed to undergo the operation of grinding. It is very difficult to pronounce the quality of some drugs when in a state of powder, and the best guarantee of their purity is a careful selection of pieces previous to grinding. Great care should also be taken in the process of drying the substances as a preliminary step to grinding ; otherwise their medicinal activity may be greatly impaired by this part of the

operation. In spite of all care, however, in the case of drugs possessing fugitive principles, there is always a certain deterioration. But when the substance contains a good deal of water, and is not readily injured in its properties by a drying heat, its strength is increased by powdering—that is, weight for weight; the relative increase of strength being equal to the loss of water. Powdered opium is an example of this. Powders are apt to be contaminated in their passage through the mill by admixture with the remnants of the substance previously ground, unless the rollers be carefully cleaned after each operation.

In some cases it is necessary, in order to reduce a substance to powder, to operate upon it in the presence of another substance, whose sole object is, by its greater hardness, to separate the particles of the drug. This agent is called a *medium* or *intermedium*, and the process is termed *mediate* or *intermediate pulverization*. The degree of fineness to which a substance is to be powdered is a matter of importance. The more minutely a substance is divided the more readily and powerfully it will act on the system; but substances containing delicate and fugitive principles are apt to be rendered inert, if the pulverization be carried too far.

Very fine powders may be obtained by the process of *dusting*. This may be effected by passing the finer particles of the powder through a lawn sieve, as in the *dusting-bottle;* or by means of a gentle current of air, so directed as to convey the lighter particles to a convenient receptacle, during the operation of grinding or triturating. *Sifting* is merely a part of the process of pulverization. When the substance has passed between the rollers, it is transferred, in portions, to the *drum-sieves* or sifting apparatus, which is generally worked by the same machinery as the rollers. The particles which are too coarse to pass through the sieves are returned to the mill.

Solution.—This process may be either of a simple or a complex character. It is *simple* when the substance dissolved can be recovered without having undergone any change; and it is *chemical* or *complex* when the substance is changed in its nature, so that on the evaporation of the solvent, or its removal by other means, it cannot be recovered in its original condition. Many of the officinal compounds are prepared by *chemical or complex solution*, as in the case of *Liquor Ammoniæ Acetatis;* but many others are prepared by *simple solution*, the object of which is merely to overcome the attraction of aggregation in the solid body, and to reduce it to a state of the finest division. In this form, medicines

are more readily taken into the system than in any other ; because either within or out of the body, they must undergo solution before they can be taken into the circulation. The fluid used to dissolve the substance is called a *solvent* or *menstruum.* Of these, several are ordered in the Pharmacopœia—as water, at various temperatures, rectified and proof spirit, sherry, ether, &c.—for the preparation of infusions, decoctions, solutions, tinctures, and wines.

The term *Saturation* has both a strictly chemical and a pharmaceutical or physical signification. In the former sense, it is synonymous with neutralization, as when a certain quantity of acid is said to saturate or neutralize a given quantity of alkali. But when a liquid has dissolved as much of a solid substance as it is capable of taking up, the solvent is saturated in the physical sense. And it is to be remembered that when a solvent is saturated with one substance, so that it cannot take up any more of the same, it is still frequently available as a solvent of a different substance.

Sublimation,—the vaporization of solid substances, or, as it is sometimes called, *dry distillation*—is the process by which volatile principles, either previously existing or occasioned by the process, are obtained from dry substances. The process is conducted by the successive application of heat and cold to the substance. By the former the volatile principles are converted into vapour, and by the latter the vapour is *condensed* into the solid form. Calomel, corrosive sublimate, benzoic acid, camphor, &c., are prepared by this process.

Trituration is one of the processes applied to the pulverization of drugs. When the substance is small in quantity, trituration is performed by means of the pestle and mortar, either worked by hand or by machinery. *Porphyrization* and *levigation* are modifications of trituration. On a large scale, drugs are powdered by grinding. See *Pulverization.*

Washing.—Impurities may be removed from precipitates, crystals, &c., by *washing.* This may be done by passing a stream of water, or other fluid, over them, projected from one of the *wash-bottles* so common in chemical and pharmaceutical laboratories.

Weights and Measures.—We cannot advance a step in our subject without a knowledge of the operations of weighing and measuring, and acquainting ourselves with the relative value of the different weights and measures. There are no processes in more frequent use than weighing and measuring, no instruments more important than the balance and the measure. A steady hand, quick

eye, and keen perception, combined with careful and dexterous manipulation, are essential to the performance of these operations; and such qualities on the part of the operator will be unavailing, unless they be supported by clean and accurate instruments.

There is at present no universal standard by which the weights and measures of different countries can be tested. Attempts have been made to reduce them to a common denomination, fixed by an immutable standard, but hitherto these attempts have been unsuccessful. The *metrical system* of weights and measures has been adopted in many countries, and is now in its *permissive* stage in the United Kingdom. It is much more suitable than our ordinary systems for analytical purposes, and is generally adopted by scientific men. The danger involved in introducing into the mixing and dispensing of medicines a system of weights and measures, as yet comparatively unknown and ill understood in this country, has, however, deterred the authors of the present Edition of the British Pharmacopœia from giving it even as an alternative method, with the single exception of the formulæ for volumetric estimations. Its many advantages will doubtless bring it ultimately into general use. But with this we have not to deal; it is sufficient that we guard ourselves against errors that would lead to mischievous, if not dangerous, results in the preparation of simple and compound medicines.

The Balance.—For weighing substances that differ much in volume and density several balances are required. For ordinary purposes in preparing and dispensing medicines at least three are necessary—one for grains and parts of a grain; one for ounces and upwards; and one for pounds and upwards. For analytical purposes the balance must be exceedingly accurate and sensitive, so that one-hundredth of a grain, or less, added to one of the pans, may be decidedly appreciable. The Royal Society of London possesses an instrument, made by Ramsden, which will turn with the one-hundredth of a grain when loaded with ten pounds weight; and another instrument, by the same maker, is said to show a distinct movement on the addition of one sixteen-hundredth of a grain when loaded with five ounces. But for general pharmaceutical purposes a much less delicate instrument is needed; and for ordinary dispensing purposes, a balance turning readily with the tenth of a grain, is sufficiently sensitive. For coarser weighing, stronger and less delicate instruments are used.

The lever of the balance should be inflexible, and the balance should

never be over-weighted. A balance that has been constructed to weigh parts of a grain should never be loaded with ounces, nor an ounce balance with pounds, otherwise the instrument cannot afterwards be depended upon for the smaller quantities.

The arms of the lever must be exactly the same in length and weight, otherwise the result of the weighing will be incorrect. The smallest difference with respect to the length of the arms will lead to error; but, unless carefully examined and tested, an imperfection of this kind may be overlooked. The unloaded pans of an instrument having this imperfection, may be apparently in perfect equipoise, and yet substances weighed in them will not afford the same results when the operation is conducted in a standard instrument. To guard against error, or to make use of a balance known to be of unequal arms, the following plan may be adopted:—Weigh the substance carefully, either by weights, or by means of any finely-divided substance, such as sand or small shot; then remove the substance from the pan, and restore the equilibrium of the balance by standard weights, which will accurately indicate the weight of the substance replaced by them. This is called *Double Weighing.* To ascertain whether a balance has this imperfection or not, it is only necessary to weigh some substance carefully, and then transpose the weights and the substance; if the results be the same, the balance is correct. Other points of importance in the selection of a balance are chiefly these: that the fulcrum be placed above the centre of gravity of the beam, that the fulcrum and the suspension points of the scales be exactly on the same level, and that friction be reduced to a *minimum.*

Weights may lead to errors from two causes: first, from not having been correctly made; and, second, from loss of a portion of their substance through *wear and tear.* A set of standard weights should be carefully preserved for occasionally testing the weights in use. When in use, both the balance and weights must be kept from the effects of substances capable of injuring them, such as powerful chemical re-agents. When not in use they are to be kept in a suitable case, free from dirt, and protected from rough usage.

Measures.—Up to a certain capacity, the measures used in pharmacy are commonly made of glass; beyond that they are made of metals. Like weights, measures are often incorrectly made; and when graduated they are not unfrequently erroneously marked. Glass measures have the advantages of transparency, cleanliness, and of remaining unaltered in capacity. Metallic measures are liable to

indentation, which obviously alters their capacity. With an accurate balance and weights, the capacity of measures may be readily tested. All that is necessary to be done is to place the suspected measure upon a perfectly smooth and level surface, pour into it a certain quantity of distilled water, at the temperature of 60° Fahr., until it reaches the mark to be tested, and ascertain the weight of the water. A gallon measure should be accurately filled by ten pounds of water; a pint measure by 1·25 pounds of water; a fluid ounce measure by one ounce; a fluid drachm measure by 54·68 grains; and the space occupied by a minim is equal to that occupied by water weighing 0·91 of a grain.

In dispensing medicines, the measure next in capacity to the quantity to be measured should be used. Because, however accurate the graduation may be, where the area of the measure is large, it is impossible to determine exactly the quantity in the measure. Thus a drachm should be separated by means of the one or two drachm measure, not by the ounce measure; an ounce by the ounce, not by the pint, measure.

The Minim and the Drop.—Sixty minims make one fluid-drachm, but sixty drops may be either more or less than a fluid-drachm, according to circumstances. The size of a drop—that is, the smallest quantity of liquid that will fall by its own gravity—is susceptible of modification by several circumstances. The quantity of fluid contained in a drop varies, for example, according to the size and shape of the vessel from which it is poured. Drops of different liquids also vary in size to a considerable extent, so that a *poured* drop may range from one-third to three times the volume of a *measured* drop or *minim*. It is manifest, therefore, that in dispensing medicines the measure should always be employed. When a more than ordinary degree of accuracy is required, the *Minim-Meter* is used.

Specific Gravity.—The specific gravity of a medicine is frequently one of its most important characters, and we may often determine the purity and strength of a medicine by this test alone. In the preparation of fluid medicines we are guided by their specific gravities in fixing the degree of dilution or concentration. For example, the specific gravity of well-prepared dilute nitro-hydrochloric acid is 1·074, and that of Syrup of Tolu is 1·330; and if they have any other specific gravity they are faulty. It is obviously important, therefore, that we should be able readily and accurately to apply this test. The specific gravity of a medicinal substance is its density as compared with that of an equal volume of pure distilled

water at a temperature of 60° Fahr., if the substance be solid or liquid; or, as compared with the density of an equal volume of atmospheric air of equal temperature, if the substance be gaseous. Different methods are pursued for testing the specific gravities of solid, liquid, and gaseous or vaporous substances; but for ordinary purposes the *Hydrometer* (*Areometer*, *Gravimeter*) is most useful, for it is of comparatively rare occurrence that we are called upon in practice to test the density of solids or gases. The *hydrometer* is an instrument used for ascertaining the specific gravities of liquids, and of this there are several varieties, differing in name and construction, according to the views of the inventors, or the purpose for which the instrument is destined. It receives the name of Alcohometer (for alcohol), Elæometer (for oils), Galactometer (for milk), Saccharometer (for syrups), Urinometer (for urine), &c. *Specific gravity beads* are hydrometers, and are used for similar purposes. The *specific gravity bottle* is also used; it is a bottle capable of holding a definite quantity of pure water at 60° Fahr. It is usually made to contain a thousand grains weight of water, and, when accurately filled with any other liquid at the same temperature, its weight represents the specific gravity of that liquid. All the instruments now mentioned, equally with the ordinary weights and measures, are subject to imperfections, and none should be used that has not been specially tested. The volume and density of a liquid is altered by variations of temperature, and, therefore, the results given by testing the specific gravity would be erroneous, unless taken at the temperature at which the standard is fixed. Formerly the temperature for taking specific gravities of medicines was 62° Fahr.; but in the British Pharmacopœia the operation is ordered to be conducted at 60° Fahr. When purchasing hydrometers it is important to know the temperature at which they were made, because if the specific gravity of a liquid be taken at a temperature differing from that at which the instrument was graduated, a certain correction must be made upon the result.

Weights and Measures of the British Pharmacopœia, with their Symbols.

WEIGHTS.

1 Grain.	gr.		. . .	=	1 grain.
1 Ounce.	oz.		. . .	=	437·5 grains.
1 Pound.	lb.	=	16 ounces	=	7000 grains.

Measures of Capacity.

1 Minim.	min.	=	1 minim.	min. j.
1 Fluid drachm.	fl. drm.	=	60 minims.	min. lx.
1 Fluid ounce.	fl. oz.	=	8 fluid drachms.	fl. drs. viij.
1 Pint.	O	=	20 fluid ounces.	fl. oz. xx.
1 Gallon.	C	=	8 pints.	Oviij.

Temperature in all cases is to be determined by Fahrenheit's thermometer; and the specific gravity of liquids is to be taken at the temperature of 60° (formerly 62°). All liquids are ordered by measure, unless it is stated otherwise.

Measures of Length.

1 Line	=	$\frac{1}{12}$ inch.
1 Inch,	=	$\frac{1}{39 \cdot 1393}$ seconds pendulum.
12 Inches,	=	1 foot.
36 „	=	3 feet = 1 yard.

Length of pendulum vibrating seconds of mean time in the latitude of London, in a vacuum at the level of the sea, ... } 39·1393 inches.

Relation of Measures to Weights of British Pharmacopœia.

1 Minim is the measure of		0·91 grains of water.	
1 Fluid drachm	„	54·68	„
1 Fluid ounce	„	1 ounce, or 437·5	„
1 Pint	„	1·25 lbs., or 8,750·0	„
1 Gallon	„	10 lbs., or 70,000·0	„

Weights and Measures of the Metrical System.

1 Milligramme	=	the thousandth part of 1 gramme, or	0·001	grm.
1 Centigramme	=	the hundredth part „	0·01	„
1 Decigramme	=	the tenth part „	0·1	„
1 Gramme	=	weight of a cubic centimetre of water at 4° Centigrade, .	1·0	„
1 Decagramme	=	ten grammes, ...	10·0	„
1 Hectogramme	=	one hundred grammes, . .	100·0	„
1 Kilogramme	=	one thousand grammes, .	1000·0	„

Measures of Capacity.

1 Millilitre	=	1 Cubic Centimetre, or the measure of		1	gramme of water.	
1 Centilitre	=	10	„	„ 10	„	
1 Decilitre	=	100	„	„ 100	„	
1 Litre	=	1000	„	„ 1000	„	(1 kilo.)

Measures of Length.

1 Millimetre	=	the thousandth part of one metre, or	0·001	metre.
1 Centimetre	=	the hundredth part „	0·01	„
1 Decimetre	=	the tenth part „	0.1	„
1 Metre	=	the ten-millionth part of a quarter of the meridian of the Earth.		

Relation of Weights of the British Pharmacopœia to Metrical Weights.

1 Grain	=	0·0648	grammes.
1 Ounce	=	28·3495	„
1 Pound	=	453·5925	„

Relation of Measures of the British Pharmacopœia to Metrical Measures.

1 Minim	=	0·000059	litres.
1 Fluid drachm	=	0·003549	„
1 Fluid ounce	=	0·028396	„
1 Pint	=	0·567936	„
1 Gallon	=	4·543487	„

Relation of the Metrical Weights to the Weights of the British Pharmacopœia.

1 Milligramme	=	0·015432 grs.
1 Centigramme	=	0·15432 „
1 Decigramme	=	1·5432 „
1 Gramme	=	15·432 „
1 Kilogramme	=	2 lbs. 3 oz. 119·8 grs., or 15432·348 grs.

Relation of the Metrical Measures to the Measures of the British Pharmacopœia.

1 Millimetre	=	0·03937 inches.
1 Centimetre	=	0·39371 „
1 Decimetre	=	3·93708 „
1 Metre	=	39·37079 „ or 1 yard 3·37 inches.
1 Cubic centimetre	=	15·432 grain measures.
1 Litre	=	1 pint 15 oz. 2 drs. 11 min., or 15432.348 grain measures.

Weights.—The weights of the British Pharmacopœia differ from those of any previous pharmacopœia. They consist of a combination of two systems,—namely, the *avoirdupois* pound and ounce, with the *troy* grain. Formerly, troy, or apothecaries' weight, was

exclusively used in pharmacy, and its relative proportions were as follows :—

1 Grain	—	gr.	. . . .		=	1 grain.
1 Ounce	—	oz.	. . . .		=	480 grains.
1 Pound	—	lb.	=	12 ounces	=	5760 „

But the Dublin College of Physicians, in the last edition of its Pharmacopœia, set aside the old troy weight, by adopting in its stead the imperial or avoirdupois weights for the ounce and higher denominations,—a departure from long established usage which appeared to the Medical Council judicious and worthy of imitation. Formerly, there were two other denominations of weights between the ounce and the grain—namely, the *drachm*, equal to 60 grains, and the *scruple*, equal to 20 grains—but these have been abandoned by the Medical Council, for the following reasons: In troy or apothecaries' weight, the drachm and the scruple are both multiples of the grain, and integral parts of the higher denominations of weights, the ounce and the pound. But the troy grain will not adapt itself both to the old drachm and scruple and to the avoirdupois ounce and pound. If 60 grains were held to represent the drachm, then eight drachms would no longer represent the ounce, for $8 \times 60 = 480$ grains, which is the troy ounce, whereas the avoirdupois ounce, now used, equals only 437·5 grains. In like manner, if the drachm were 60 grains, then 128×60 (*i. e.*, the number of drachms in sixteen ounces multiplied by the number of grains in a drachm) would give 7680 grains to the pound, whereas the present pound is only equal to 7000 grains; and so also with the scruples. If they would have preserved the drachm and the scruple, the Medical Council would have had either to alter the relative value of these weights, as the Dublin College did—making the drachm to equal 54·68 grains, and the scruple to equal 18·22—or to substitute a new medical grain for the troy grain, hitherto the medical as well as the standard grain of the kingdom. But in deference to the general feeling of the medical profession, in the second edition of the British Pharmacopœia, the Medical Council so far relaxed the stringency of their proscription of the use of the lower denominations, drachm and scruple, as to leave it optional with the physician to use in prescribing, if he considered it more convenient, the symbols (ʒ) and (℈), instead of 60 grains and 20 grains respectively. They recommend, however, that drachm (or ʒ) shall in all cases mean 60 grains troy, and never the eighth part of

the avoirdupois ounce; and that scruple (or ℈) shall in like manner mean 20 grains troy, and never the twenty-fourth part of the ounce.

MEASURES.—The measures of the British Pharmacopœia remain unchanged. It was considered impossible to improve the system which has become so familiar.

SYMBOLS.—The following changes have been made in the symbols of the weights and measures :—oz. instead of ℥ ; fl. oz. instead of f ℥ ; fl. dr. instead of f ʒ ; min. instead of ♏ ; and lb. (avoirdupois) instead of ℔ (troy), the bar across the letters being omitted. The numbers representing the quantity of solid ingredients are Arabic, those representing the quantity of fluids are Roman numerals.

Officinal Formulæ.

Prescription has a wider signification than *Formula*, for it includes general directions as to the treatment of the patient, not only by medicine, but also by diet, clothing, exercise, ventilation, &c.

Formula (diminutive of Forma, *a form, scheme, rule, recipe*) is restricted to the directions given in writing for the preparation and application of medicinal remedies. A *simple formula* consists of one medicinal preparation, either simple or compound. A *compound formula* consists of two or more. A formula constructed *extemporaneously* by the physician is called *magistral, i.e.*, written by a *master* of his profession. *Officinal* medicines are properly *shop*-medicines, because kept ready for use in shops (*officina*); but we confine the term to those prepared according to the formulæ of the British Pharmacopœia : therefore, a medicine that is "not officinal" is to be understood as not having the sanction of the Pharmacopœia. The individual formulæ for the preparation of officinal remedies will be given hereafter, under the name of each of the chief ingredients ; but there are certain groups of formulæ for what are indefinitely termed *Galenical preparations*, which it will be serviceable at once to pass in review. They are the following :—

Aquæ.—There are twelve formulæ for *Distilled Waters* in the British Pharmacopœia. *Aqua Aurantii* is also *officinal*, but as it is chiefly imported from France, it is not included in the following list. Ten of the "waters" are rendered medicinal by distilling them with certain vegetable substances, whilst another is simply *Spring water* rendered tasteless and inodorous, and deprived as much as possible of impurities, by distillation. The volatile principles separated and retained by the distilled waters, are either abstracted from some part of the solid substance of the plant, as in *Aqua Anethi, Carui*,

Cinnamomi, Fœniculi, Lauro-cerasi, Pimentæ, Rosæ et *Sambuci;* or from the volatile oils previously obtained from the plants, as in *Aqua Menthæ Piperitæ et Aqua Menthæ Viridis. Aqua* (formerly *Mistura*) *Camphoræ* is an exception to the rule ; it is prepared by simply keeping the camphor immersed in distilled water. (See *Aq. Camph.*)

Distilled Waters are chiefly used as vehicles for other medicines ; but some of them are given to children alone, in doses of *fl. dr.* i-ii, and to adults in doses of *fl. oz.* ss-j. *Aqua Lauro-cerasi* is a very uncertain preparation, as to its strength, and is never given to children, and to adults in doses not exceeding min. x to *fl. dr.* i. *Aqua Rosæ* is chiefly used as an elegant vehicle for lotions and collyria. The distilled waters formerly contained spirit to preserve them ; but far from this, it spoiled them by undergoing the acetous fermentation (Warrington).

Aqua.

		Water.	Distil.
Anethi.	Dill, *lb.* 1. . . . * .	C 2	C 1
Camphoræ (*Mistura*).	Camphor, *oz.* ½. . (distilled)	C 1	
Carui.	Caraway, *lb.* 1. . . .	C 2	C 1
Cinnamomi.	Cinnamon, *oz.* 20. . . .	C 2	C 1
Destillata.	Water, free from taste and odour.	C 10	C 8
Fœniculi.	Sweet fennel fruit, *lb.* 1. . .	C 2	C 1
Lauro-cerasi.	Fresh leaves of common laurel, *lb.* 1.	O 2½	O 1
Menthæ Piperitæ.	Oil of peppermint, *fl. drs.* 1½. .	C 1½	C 1
Menthæ Viridis.	Oil of spearmint, *fl. drs.* 1½. .	C 1½	C 1
Pimentæ.	Pimento, *oz.* 14. . . .	C 2	C 1
Rosæ.	Fresh petals of Rosa centifolia, *lb.* 10.	C 2	C 1
Sambuci.	Fresh elder flowers, free from stalks, *lb.* 10.	C 2	C 1

Cataplasmata.—There are six formulæ for *Poultices* in the British Pharmacopœia. Poultices consist of—the *liquor*, or fluid part ; the *corpus*, or substance of the poultice ; and the *accessorium*, or active medicinal ingredient. Of the officinal cataplasms, the *liquor* is boiling water (with one exception, *C. Fermenti*) ; the *corpus* is linseed meal, bread, or flour ; and the *accessorium* is charcoal, hemlock leaf, beer yeast, mustard, or chlorinated soda. Water at a higher temperature than 100° would interfere with the catalytic process in C. Fermenti. *Magistral* cataplasms may include many other ingredients, whether liquid or solid. When an active medicinal substance is added, it must be incorporated with the *liquor* and *corpus* of the poultice at such a temperature that, if fugitive, it be not driven off ;

and in such a manner as to approach near to the part to which the poultice is applied, for a remedial agent buried in the depths of a thick, tenacious poultice would be of little service. The *liquor* may consist of a decoction of a medicinal plant. Cataplasms, though easily made, demand both knowledge and care; for, as Dr Paris said, "Science does not withhold her aid even on the humble occasion of making a poultice." The temperature and tenacity of the poultice are important points: it should have a medium consistency, neither too dry nor too soft, and should be able to supply a sufficiency of moisture, without scattering its *liquor* to the discomfort of the patient. Poultices are employed chiefly to supply warmth and moisture; they are sometimes applied cold, more frequently tepid, and sometimes as hot as the patient can bear them, and are used according to circumstances, as *emollients, stimulants, or counter-irritants* (sinapisms), *sedatives, antiseptics, refrigerants*, &c. When the part is to be softened and lubricated, fatty substances are added. *Spongio-piline* is sometimes used as an elegant substitute for a cataplasm when heat and moisture alone are required.

Cataplasma.

Carbonis.	Wood charcoal, *oz.* ½; bread, *oz.* 2; linseed meal, *oz.* 1½; boiling water, *fl. oz.* 10.
Conii.	Hemlock leaf, *oz.* 1; linseed meal, *oz.* 3; boiling water, *fl. oz.* 10.
Fermenti.	Beer yeast, *fl. oz.* 6; flour, *oz.* 14; water, at 100°, *fl. oz.* 6.
Lini.	Linseed meal, *oz.* 4; olive oil, *fl. oz.* ½; boiling water, *fl. oz.* 10.
Sinapis.	Mustard, *oz.* 2½; linseed meal, *oz.* 2½; boiling water, *fl. oz.* 10.
Sodæ Chloratæ.	Solution of chlorinated soda, *fl. oz.* 2; linseed meal, *oz.* 4; boiling water, *fl. oz.* 8.

Confectiones.—There are eight formulæ for *Confections* in the British Pharmacopœia. The terms *Electuarium* and *Conserva* are abolished. Confections serve two chief purposes; they are useful as excipients for medicines that are given in large quantities, such as powders, which, being almost insoluble, cannot be given agreeably in the form of mixture; and they serve also to give a proper consistency to pill masses. The solid substances of the confection are formed into a softish pasty mass by means of honey, syrup, mucilage, treacle &c. Those made with mucilage soon become hard, and syrup

is apt to crystallize, unless certain precautions be used. These medicines are of ancient date, and formerly consisted of most chaotic masses, but they are now comparatively seldom used. Several of the confections of older pharmacopœias are no longer officinal, and two have changed their names and condition, namely, the old *Confectio Amygdalæ*, or *Conserva Amygdalarum*, which is now a dry preparation under the name of *Pulvis Amygdalæ Compositus;* and the old *Confectio Aromatica* (P. L.), which is now represented, with some changes, by *Pulvis Cretæ Aromaticus.*

CONFECTIO.

Opii.	Compound powder of opium, *gr.* 192; syrup, *oz.* 1.
Piperis.	Black pepper, *oz.* 2; caraway, *oz.* 3; clarified honey, *oz.* 15.
Rosæ Caninæ.	Hips, deprived of seeds, *lb.* 1; refined sugar, *lb.* 2.
Rosæ Gallicæ.	Fresh red-rose petals, *lb.* 1; refined sugar, *lb.* 3.
Scammonii.	Scammony, in fine powder, *oz.* 3; ginger, *oz.* 1½; oil of caraway, *fl. dr.* 1; oil of cloves, *fl. dr.* ½; syrup, *fl. oz.* 3; clarified honey, *oz.* 1½.
Sennæ.	Senna, *oz.* 7; coriander, *oz.* 3; figs, *oz.* 12; tamarinds, *oz.* 9; cassia pulp, *oz.* 9; prunes, *oz.* 6; extract of liquorice, *oz.* ¾; refined sugar, *oz.* 30; distilled water, a sufficiency to make the result weigh *oz.* 75.
Sulphuris.	Sublimed sulphur, *oz.* 4; acid tartrate of potash, *oz.* 1; syrup of orange peel, *fl. oz.* 4.
Terebinthinæ.	Oil of turpentine, *fl. oz.* 1; liquorice root, *oz.* 1; clarified honey, *oz.* 2.

Decocta.—There are fourteen formulæ for *Decoctions* in the British Pharmacopœia. They are all made by boiling vegetable substances in water, the object of the process being to obtain principles which cannot be separated at a lower temperature. Vegetables containing fugitive principles, or such as are injured by a high temperature, cannot be used as decoctions. The time prescribed for boiling the officinal decoctions is from five to twenty minutes, except *D. Granati Radicis*, which is boiled from two pints to one; and they are to be strained immediately after the boiling, except in the cases of *D. Cinchonæ Flavæ, D. Aloes Comp., D. Sarsæ,* and *D. Sarsæ Comp.*, the first being strained when *cold*, the rest when *cool.* All the formulæ for the officinal decoctions are *simple*, ex-

cept *D. Aloes Co.* and *D. Sarsæ Co.* Decoctions are prone to change, and therefore should be made only when required, or if prepared in anticipation, should be frequently renewed.

	Decoctum.	Dist. Water.	Minutes to Boil.	Prodt.
Aloes Compositum.	Extract of socotrine aloes, *gr.* 120. Myrrh, *gr.* 90; saffron, *gr.* 90. Carbonate of potash, *gr.* 60. Extract of liquorice, *oz.* 1. Comp. tinct. of cardamoms, *fl. oz.* 8.	Q.S.	5	*fl. oz.* 30
Cetrariæ.	Iceland moss, *oz.* 1. . .	O 1	10	O 1
Cinchonæ Flavæ.	Yellow cinchona bark, *oz.* $1\frac{1}{4}$.	O 1	10	O 1
Granati Radicis.	Pomegranate root, fresh or dry, *oz.* 2. . . .	O 2	boil to	O 1
Hæmatoxyli.	Logwood chips, *oz.* 1; cinnamon, *gr.* 60. . . .	O 1	10	O 1
Hordei.	Pearl barley, *oz.* 2. . .	O $1\frac{1}{2}$	20	
Papaveris.	Poppy capsules, without seeds, *oz.* 2.	O $1\frac{1}{2}$	10	O 1
Pareiræ.	Pareira, *oz.* $1\frac{1}{2}$. . . .	O 1	15	O 1
Quercus.	Oak bark, *oz.* $1\frac{1}{4}$. . .	O 1	10	O 1
Sarsæ.	Jamaica sarsaparilla, cut transversely, *oz.* $2\frac{1}{2}$. . .	O $1\frac{1}{2}$	10	O 1
Sarsæ Compositum.	Jamaica sarsaparilla, cut transversely, *oz.* $2\frac{1}{2}$. Sassafras chips, *oz.* $\frac{1}{4}$. Guaiac wood turnings, *oz.* $\frac{1}{4}$. Fresh liquorice root, *oz.* $\frac{1}{4}$. Mezereon, *gr.* 60.	O $1\frac{1}{2}$	10	O 1
Scoparii.	Dried broom tops, *oz.* 1. .	O 1	10	O 1
Taraxaci.	Dried dandelion root, *oz.* 1. .	O 1	10	O 1
Ulmi.	Elm bark, in small pieces, *oz.* $2\frac{1}{2}$. . . .	O 1	10	O 1

Emplastra.—There are fourteen formulæ for *Plasters* in the British Pharmacopœia. Several of the old plasters are omitted, but there are no additions, except that *Ceratum Saponis Compositum* of the London Pharmacopœia is introduced under the name of *Emplastrum Cerati Saponis.* All true plasters have for their basis

litharge, in combination with *Oleic*, *Margaric*, and *Stearic* acids. Eleven of the officinal plasters are so prepared. The rest are not strictly plasters, although so called; they owe their consistency either to wax, suet, resin, and lard, as in *Emp. Cantharidis;* to pitch, frankincense, resin, wax, &c., as in *Emp. Picis;* or to the chemical action of the ingredients upon one another, as in *Emp. Ammoniaci cum Hydrargyro.* Plasters are used externally, and adhere more or less firmly to the surface of the body, according to the amount of resin present; but as this is an irritating ingredient, its quantity should be modified according to the sensitiveness of the skin, and other circumstances. Changes may be made upon the officinal plasters; other ingredients may be added or quantities modified; but commonly one or other of the officinal forms is prescribed. They are kept in rolls, and are spread to the required size upon leather, cloth, calico, linen, silk, or other fabric (but chiefly leather), to suit the occasion, care being taken not to injure them by melting them at a needlessly high temperature. Plasters are used to give mechanical support, and also as a mode of the external application of medicines, and are to be selected accordingly. *Emplast. Cantharidis* is vulgarly called "*a blister*," or "*a rising blister.*"

EMPLASTRUM.

Ammoniaci cum Hydrargyro.	Ammoniac, *oz.* 12; mercury, *oz.* 3; olive oil, *fl. dr.* 1; sulphur, *gr.* 8.
Belladonnæ.	Extract of belladonna, *oz.* 3; resin plaster, *oz.* 3; rectified spirit, *fl. oz.* 6.
Calefaciens.	Cantharides, *oz.* 4; expressed oil of nutmeg, *oz.* 4; yellow wax, *oz.* 4; resin, *oz.* 4; soap plaster, *lb.* 3¼; resin plaster, *lb.* 2; boiling water, *O* 1.
Cantharidis.	Cantharides, *oz.* 12; yellow wax, *oz.* 7½; prepared suet, *oz.* 7½; resin, *oz.* 3; prepared lard, *oz.* 6.
Cerati Saponis.	Hard soap, *oz.* 10; yellow wax, *oz.* 12½; olive oil, *O* 1; oxide of lead, *oz.* 15; vinegar, *C* 1.
Ferri.	Peroxide of iron, *oz.* 1; Burgundy pitch, *oz.* 2; lead plaster, *oz.* 8.
Galbani.	Galbanum, *oz.* 1; ammoniac, *oz.* 1; yellow wax, *oz.* 1; lead plaster, *oz.* 8.
Hydrargyri.	Mercury, *oz.* 3; olive oil, *fl. dr.* 1; sublimed sulphur, *gr.* 8; lead plaster, *oz.* 6.

Opii.	Finely powdered opium, *oz.* 1; resin plaster, *oz.* 9.
Picis.	Burgundy pitch, *oz.* 26; common frankincense, *oz.* 13; resin, *oz.* 4½; yellow wax, *oz.* 4½; expressed oil of nutmeg, *oz.* 1; olive oil, *fl. oz.* 2; water, *fl. oz.* 2.
Plumbi.	Oxide of lead, *lb.* 4; olive oil, *C* 1; water, *O* 3½.
Plumbi Iodidi.	Iodide of lead, *oz.* 1; soap plaster and resin plaster, of each *oz.* 4.
Resinæ.	Resin, *oz.* 4; lead plaster, *lb.* 2; hard soap, *oz.* 2.
Saponis.	Hard soap, *oz.* 6; lead plaster, *lb.* 2¼; resin, *oz.* 1.

Enemata.—There are six formulæ for *Enemata* in the British Pharmacopœia. A great variety of *Magistral* formulæ for enemata are constructed to suit special circumstances. We shall revert to this subject when treating of the channels by which medicines are introduced into the system.

ENEMA.

Aloes.	Aloes, *gr.* 40; carbonate of potash, *gr.* 15; mucilage of starch, *fl. oz.* 10.
Assafœtidæ (Fœtidum).	Assafœtida, *gr.* 30; distilled water, *fl. oz.* 4.
Magnesiæ Sulphatis (Catharticum).	Sulphate of magnesia, *oz.* 1; olive oil, *fl. oz.* 1; mucilage of starch, *fl. oz.* 15.
Opii.	Tinct. of opium, *fl. dr.* ½; mucilage of starch, *fl. oz.* 2.
Tabaci.	Tobacco leaf, *gr.* 20; boiling water, *fl. oz.* 8.
Terebinthinæ.	Oil of turpentine, *fl. oz.* 1; mucilage of starch, *fl. oz.* 15.

Essentiæ.—Essences, as distinguished from spirits, are strong solutions of volatile oils. Two are introduced into the British Pharmacopœia, and they each contain one part of the volatile oil to four of rectified spirit.

ESSENTIA.

Anisi.	Oil of anise, *fl. oz.* 1; rectified spirit, *fl. oz.* 4.
Menthæ Piperitæ.	Oil of peppermint, *fl. oz.* 1; rectified spirit, *fl. oz.* 4.

Extracta.—There are thirty-six formulæ for *Extracts* in the British Pharmacopœia. Many of the old extracts are omitted, and several new ones added. Among the latter is a new order of "liquid" extracts. *Extractum Cinchonæ Flavæ Liquidum* is very nearly the same as the old *Infusum Cinchonæ Spissatum*, and the

Extractum Filicis Liquidum was formerly called *Oleum Filicis-Maris.* Extracts, when carefully prepared, are an exceedingly useful class of remedies; but, unfortunately, they are often spoiled in the making, and are then worse than useless. We shall briefly examine the process of the preparation in three stages. 1. The substances from which they are prepared, and the preliminary steps taken with them. 2. The separation of the active principles. 3. The evaporation.

1. Extracts are derived from different parts of plants, *e. g.*, fresh leaves, flowering tops, young branches, flowers, roots, barks, corms, woods, resins, &c.; and these are subjected to some preliminary operations, such as bruising, crushing, coarsely and finely powdering, slicing, &c.

2. The active principles are separated by various means, such as—by simply squeezing out the juice—*fresh* or *green extracts;* by cold or boiling distilled water—*aqueous extracts;* by rectified, proof, or more diluted spirit—*alcoholic extracts;* by ether, *ethereal extracts;* by acetic acid—*acetic extract.* In the preparation of *fresh* or *green* extracts the juice of the plant is pressed out and at once evaporated. The solutions from which the *aqueous* extracts are made are prepared either by *decoction, infusion,* or *digestion in boiling water,* or by *maceration in cold water,* and are recovered either by means of the press or by displacement. *Alcoholic* extracts are prepared by macerating the substances in the spirit for a fixed time, recovering the solution by pressure or percolation, and removing the spirit by distillation. In the preparation of *Ext. Ergotæ Liquidum,* the ergot is first percolated with ether to remove its oil, and afterwards it is prepared as an aqueous extract. *Extractum Filicis Liquidum* is percolated with ether (which is either removed by the water-bath or recovered by distillation) to procure at once the oily extract.

3. It is only now, when the active principles have been extracted from the vegetable substances and are held in solution, that the difficulty and danger begin. The next step is to bring them to the state of extracts without injuring them. The chief risks to which they are exposed in this part of the process, are excessive heat and atmospheric influences. Evaporation may be conducted—1. Spontaneously; 2. Over a naked fire: 3. In a water-bath or steam-bath; 4. In vacuo. The plan to be adopted will depend upon the nature of the ingredients, the more common method being by the water-bath or steam-bath. When a very low temperature is desirable, the pressure of the atmosphere is removed, the evapora-

tion being conducted *in vacuo.* The lower the temperature the better, provided it be sufficient to conduct the process with promptness, but a lingering process leads to injurious chemical changes. Two things are essential to the *preservation* of extracts—*coolness* and *dryness;* a high temperature promotes fermentation; a damp atmosphere causes mouldiness. The *green colour* of fresh extracts is sometimes urged as a proof of the excellence of the preparation, but it is no proof at all, seeing that the green colouring matter is carefully nursed, whilst the active part of the extract is undergoing the critical process of evaporation.

Liquid or *fluid* extracts have been gradually coming into use for several years, and are found to be very suitable preparations for many medicines. They are seven in number, but two of them under other names were previously officinal. The liquid extracts of *Bael*, *Ergot*, and *Pareira* are made in such a way that each fluid part represents an equal part of the drug employed, a fluid ounce of the preparation being equal to a solid ounce of the vegetable. Extracts contain the medicinal constituents of plants reduced to a minimum bulk, and, when carefully prepared, are very useful, for they generally create less objection on the part of the patient than any other form of medicine. They are given either alone or in combination with other medicines either in the form of a pill, or (the aqueous variety) dissolved in mixture. The initials in the following list signify :—*a.* Extracts prepared from the fresh juice (*fresh* or *green*); *b. aqueous extracts; bb. alcoholic extracts; c. liquid extracts; cc. liquid extracts* prepared more or less by ether; *aa. fresh* or *green extracts*, but the process a little different.

Extractum.

a. Aconiti.	Fresh leaves and flowering tops of aconite, *lb.* 112.
b. Aloes Barbadensis.	Barbadoes aloes, *lb.* 1; boiling dist. water, *C*1.
b. Aloes Socotrinæ.	Socotrine aloes, *lb.* 1; boiling dist. water, *C*1.
b. Anthemidis.	Chamomile flowers, *lb.* 1; oil of chamomile, *min.* 15; distilled water, *C*1.
c. Belæ Liquidum.	Bael, *lb.* 1; distilled water, *O*12; rectified spirit, *fl. oz.* 2.
a. Belladonnæ.	Fresh leaves and young branches of belladonna, *lb.* 112.
bb. Calumbæ.	Calumba, *lb.* 1; distilled water, *O*4.
bb. Cannabis Indicæ.	Indian hemp, *lb.* 1; rectified spirit, *O*4.

c. *Cinchonæ Flavæ Liquidum.*	Yellow cinchona bark, *lb.* 1 ; distilled water, *Q.S.*; rectified spirit, *fl. oz.* 1.
aa. *Colchici.*	Fresh colchicum corms, deprived of their coats, *lb.* 7.
aa. *Colchici Aceticum.*	Fresh colchicum corms, deprived of their coats, *lb.* 7 ; acetic acid, *fl. oz.* 6.
bb. *Colocynthidis Compositum.*	Colocynth, freed from seed, *oz.* 6 ; extract of socotrine aloes, *oz.* 12 ; resin of scammony, *oz.* 4; hard soap, *oz.* 3 ; cardamoms, in fine powder, *oz.* 1 ; proof spirit, *C*1.
a. *Conii.*	Fresh leaves and young branches of hemlock, *lb.* 112.
cc. *Ergotæ Liquidum.*	Ergot, *lb.* 1 ; ether, *O*1 or *Q.S.* ; distilled water, *O*3½; rectified spirit, *fl. oz.* 8.
cc. *Filicis Liquidum.*	Fern root, *lb.* 2 ; ether, *O*4 or *Q.S.*
b. *Gentianæ.*	Gentian, *lb.* 1 ; boiling distilled water, *C*1.
b. *Glycyrrhizæ.*	Liquorice root, *lb.* 1 ; distilled water, *O*4.
b. *Hæmatoxyli.*	Logwood chips, *lb.* 1 ; boiling dist. water, *C*1.
a. *Hyoscyami.*	Fresh leaves and young branches of hyoscyamus, *lb.* 112.
bb. *Jalapæ.*	Jalap, *lb.* 1; rect. spirit, *O*4; dist. water, *C*1.
b. *Krameriæ.*	Rhatany, *lb.* 1; distilled water, *Q.S.*
a. *Lactucæ.*	The flowering herb of lettuce, *lb.* 112.
bb. *Lupuli.*	Hop, *lb.* 1; rect. spirit, *O*1½; dist. water, *C*1.
cc. *Mezerei Æthereum.*	Mezereon cut small, *lb.* 1; rectified spirit, *O*8; ether, *O*1.
bb. *Nucis Vomicæ.*	Nux vomica, *lb.* 1; rectified spirit, *Q.S.*
b. *Opii.*	Thinly sliced opium, *lb.* 1; distilled water, *O*6.
c. *Opii Liquidum.*	Extract of opium, *oz.* 1; distilled water, *fl. oz.* 16; rectified spirit, *fl. oz.* 4.
bb. *Papaveris.*	Poppy capsules, dried, freed from seeds, and coarsely powdered, *lb.* 1 ; rectified spirit, *fl. oz.* 2; distilled water, *Q.S.*
b. *Pareiræ.*	Pareira root in coarse powder, *lb.* 1; boiling distilled water, *C*1 or a sufficiency.
c. *Pareiræ Liquidum.*	Pareira, *lb.* 1; boiling distilled water, *C*1 or *Q.S.*; rectified spirit, *fl. oz.* 3.
bb. *Physostigmatis.*	Calabar bean in coarse powder, *lb.* 1; rectified spirit, *O*4.
b. *Quassiæ.*	Quassia wood, rasped, *lb.* 1; dist. water, *Q.S.*
bb. *Rhei.*	Rhubarb, *lb.* 1; rect. sp. *fl. oz.* 10; dist. water, *O*5.

c. Sarsæ Liquidum.	Jamaica sarsaparilla, cut transversely, *lb.* 1; dist. water at 160°, *O*14; rect. spirit, *fl. oz.* 1.
bb. Stramonii.	Stramonium seeds, *lb.* 1; ether, *O*1 or *Q.S.*; proof spirit and distilled water, of each *Q.S.*
aa. Taraxaci.	Fresh dandelion root, *lb.* 4.

Glycerina.—This is a class of preparations made officinal for the first time in the second edition of the British Pharmacopœia. They are five in number, and form elegant vehicles for the application and administration of the active principles dissolved in the glycerine. In their formation the excellent solvent and antiseptic properties of glycerine are utilised. Glycerinum amyli was introduced a few years ago by Mr Schacht of Clifton, under the name of "plasma," as a fit substitute to replace the oily bases of ointments and other preparations. It is specially worthy of attention, as it has no tendency to become rancid, and is thus better suited than ordinary ointment to preserve any active principle liable to decomposition, while it is, at the same time, more agreeable and cleanly.

Glycerinum.

Acidi Carbolici.	Carbolic acid, *oz.* 1; glycerine, *fl. oz.* 4.
Acidi Gallici.	Gallic acid, *oz.* 1; glycerine, *fl. oz.* 4.
Acidi Tannici.	Tannic acid, *oz.* 1; glycerine, *fl. oz.* 4.
Amyli.	Starch, *oz.* 1; glycerine, *fl. oz.* 8.
Boracis.	Borax in powder, *oz.* 1; glycerine, *fl. oz.* 4.

Infusa.—There are twenty-eight formulæ for *Infusions* in the British Pharmacopœia. Infusions are prepared by pouring water upon vegetable substances, and allowing the latter to remain in the liquid for a certain length of time, varying according to circumstances. Infusions are preferred to decoctions when the substances to be operated upon are less dense, and when the desired principles can be abstracted at a temperature below the boiling point; also when we wish to preserve certain fugitive principles which impart an agreeable aroma, besides being otherwise valuable, and which would be driven off by boiling. The vegetable substances usually undergo some preliminary mechanical operation to render them more permeable; they are either *bruised*, *cut small*, *sliced*, *chipped*, or *coarsely powdered.* The temperature of the water is in twenty-four cases at the boiling-point (212° Fahr.); in two instances at 120° Fahr.; and in two *cold.* The water is used either cold or below the boiling-point, when that of a higher temperature would abstract

noxious principles, as in the case of *Inf. Calumbæ.* The time prescribed for infusion varies from ten minutes to two hours, according to the facility with which the desired principles are abstracted. Infusions are to be strained so soon as the prescribed time is past, but they are often injured from carelessness in leaving the vegetable substances indefinitely in the liquid. *Inf. Cusso* is an exception, it is not strained at all; the solids and fluids are swallowed together. Infusions are prone to change, and should therefore be frequently renewed. "Infusion of senna, which would change in twelve hours in hot weather, will keep for several days perfectly good if one grain of nitre be dissolved in each ounce of the infusion" (Squire). *Concentrated* infusions were introduced to meet difficulties of this kind, but they are found to be unsatisfactory representatives. Respecting the preservation of infusions, Mr Stephenson of Edinburgh says:—"We fill the infusion, freshly prepared and filtered, into common bottles of any convenient size, up to the bottom of the neck. These are placed in a vessel of water, put on the fire, and allowed to remain until the water has boiled round about them for ten or fifteen minutes. By this time the infusions will be found to be running over the brims of the bottles. They are then removed one by one, and immediately closed by simply tying a piece of moistened bladder over the top. We generally prepare as much of each infusion as will last for two or three months, but it will retain for years the fresh taste and aroma of its ingredients." (*Pharmaceutical Journal*, May 1859.) This is simply a modification of the method previously recommended by Mr Alsop, who closed the bottles with well-ground and slightly conical stoppers, smeared with wax. The object in both cases is to exclude air from the bottles. Infusions are chiefly used as vehicles for more active ingredients. They should be selected with the view of promoting the action of the combined medicines, or else of correcting their untoward effects. Some of them are given in a simple form, as *Inf. Cusso* and *Inf. Ergotæ.*

	Infusum.	Distilled Water. Quantity.	Distilled Water. Temp.	Minutes Infused.
Anthemidis.	Chamomile flowers, *oz.* $\frac{1}{2}$.	*fl.oz.* 10	212°	15
Aurantii.	Bitter orange peel, *oz.* $\frac{1}{2}$.	"	"	"
Aurantii Compositum.	Bitter orange peel, cut small, *oz.* $\frac{1}{4}$; fresh lemon peel, cut small, *gr.* 60; cloves, bruised, *gr.* 30.	*fl.oz.* 10	212°	15

		Distilled Water. Quantity.	Temp.	Minutes Infused.
Buchu.	Buchu, *oz.* ½.	*fl. oz.* 10	212°	60
Calumbæ.	Calumba, *oz.* ½.	„	cold.	60
Caryophylli.	Cloves, *oz.* ¼.	„	212°	30
Cascarillæ.	Cascarilla, *oz.* 1.	„	„	60
Catechu.	Catechu, *gr.* 160. Cinnamon, *gr.* 30.	„	„	30
Chiratæ.	Chiretta, *oz.* ¼.	„	120°	30
Cinchonæ Flavæ.	Yellow cinchona bark, *oz.* ½.	„	212°	120
Cuspariæ.	Cusparia, *oz.* ½.	„	120°	120
Cusso.	Kousso, *oz.* ½.	*fl. oz.* 8	212° (not strained)	15
Digitalis.	Dried digitalis, *gr.* 30.	*fl. oz.* 10	„	60
Dulcamaræ.	Dulcamara, *oz.* 1.	„	„	60
Ergotæ.	Ergot, *oz.* ¼.	„	„	30
Gentianæ Compositum.	Gentian root and bitter orange peel, of each *gr.* 60; fresh lemon peel, *oz.* ¼.	*fl. oz.* 10	212°	60
Krameriæ.	Rhatany, *oz.* ½.	„	212°	60
Lini.	Linseed, *gr.* 160. Fresh liquorice root, *gr.* 60.	„	„	240
Lupuli.	Hops, *oz.* ½.	„	„	120
Maticæ.	Matico, *oz.* ½.	„	„	30
Quassiæ.	Quassia chips, *gr.* 60.	„	cold.	30
Rhei.	Rhubarb, *oz.* ¼.	„	212°	60
Rosæ Acidum.	Red-rose petals, *oz.* ¼. Dilute sulph. acid, *fl. dr.* 1.	„	„	30
Senegæ.	Senega, *oz.* ½.	„	„	60
Sennæ.	Senna, *oz.* 1; ginger, *gr.* 30.	„	„	60
Serpentariæ.	Serpentary, *oz.* ¼.	„	„	120
Uvæ Ursi.	Bearberry leaves, *oz.* ½.	„	„	120
Valerianæ.	Valerian, *gr.* 120.	„	„	60

Linimenta.—There are sixteen formulæ for *Liniments* in the British Pharmacopœia. Formerly, some of the *tinctures* were made of extra strength for external application; but all such are now classed with the liniments, and therefore all tinctures are for internal use. True *liniments* (or *embrocations*) are of oily or saponaceous consistency, suitable, as the name implies, to *anoint* or *besmear* the part to which they are applied. Several of the officinal liniments, however, have not this character; such as *Lin. Iodi*, which has no oleaginous constituent, and *Lin. Aconiti* and *Lin. Belladonnæ*,

which have only their camphor to represent the oleaginous ingredient. These, therefore, are not suitable for application by friction, and if used alone, they must be carefully applied, in restricted quantity, by means of a camel's-hair brush, or if by inunction, they must be combined with other oily liniments. By a judicious combination of the officinal liniments with one another, or with other medicinal substances soluble in them, a great variety of magistral formulæ may be contrived to suit all cases in which the skin is the more suitable channel for the application of the medicine.

LINIMENTUM.

Aconiti.	Powdered aconite root, *oz.* 20; camphor, *oz.* 1; rectified spirit, *Q.S.* makes *O* 1.
Ammoniæ.	Solution of ammonia, *fl. oz.* 1; olive oil, *fl. oz.* 3.
Belladonnæ.	Belladonna root, *oz.* 20; camphor, *oz.* 1; rectified spirit, *Q.S.* makes *O* 1.
Calcis.	Solution of lime, *fl. oz.* 2; olive oil, *fl. oz.* 2.
Camphoræ.	Camphor, *oz.* 1; olive oil, *oz.* 4.
Camphoræ Compositum.	Camphor, *oz.* 2½; oil of lavender, *fl. dr.* 1; strong solution of ammonia, *fl. oz.* 5; rectified spirit, *fl. oz.* 15.
Chloroformi.	Chloroform, *fl. oz.* 2; liniment of camphor, *fl. oz.* 2.
Crotonis.	Croton oil, *fl. oz.* 1; oil of cajuput and rectified spirit, of each *fl. oz.* 3½.
Hydrargyri.	Ointment of mercury, *oz.* 1; solution of ammonia, *fl. oz.* 1; liniment of camphor, *fl. oz.* 1.
Iodi.	Iodine, *oz.* 1¼; iodide of potassium, *oz.* ½; camphor, *oz.* ¼; rectified spirit, *fl. oz.* 10.
Opii.	Tincture of opium, *fl. oz.* 2; liniment of soap, *fl. oz.* 2.
Potassii Iodidi cum Sapone.	Hard soap and iodide of potassium, of each *oz.* 1½; glycerine, *fl. oz.* 1; oil of lemon, *fl. dr.* 1; distilled water, *fl. oz.* 10.
Saponis	Hard soap, *oz.* 2½; camphor, *oz.* 1¼; oil of rosemary, *fl. drs.* 3; rect. spirit, *fl. oz.* 18; distilled water, *fl. oz.* 2.
Sinapis Compositum.	Oil of mustard, *fl. dr.* 1; ethereal extract of mezereon, *gr.* 40; camphor, *gr.* 120; castor oil, *fl. dr.* 5; rectified spirit, *fl. oz.* 4.
Terebinthinæ.	Oil of turpentine, *fl. oz.* 16; soft soap, *oz.* 2; camphor, *oz.* 1.
Terebinthinæ Aceticum.	Oil of turpentine, *fl. oz.* 1; acetic acid, *fl. oz.* 1; liniment of camphor, *fl. oz.* 1.

Liquores.—There are thirty-seven formulæ for *Solutions* in the British Pharmacopœia. It is convenient to remember that the strength of the following solutions is *four grains* of the active ingredient *to the ounce*, viz., *Arsenicalis, Arsenici Hydrochloricus, Atropiæ, Atropiæ Sulphatis, Morphiæ Acetatis, Morphiæ Hydrochloratis, Potassæ Permanganatis, Sodæ Arseniatis, Strychniæ*, and that of the *Perchloride of Mercury* is ½ grain to the ounce.

LIQUOR.

Ammoniæ.	Strong solution of ammonia, *O* 1; distilled water, *O* 2; *sp. gr.* 0·959.
Ammoniæ Acetatis.	Acetic acid, *fl. oz.* 10; carbonate of ammonia, *oz.* 3¼, or *Q.S.*; distilled water, *O* 2½.
Ammoniæ Citratis.	Citric acid, *oz.* 3; strong solution of ammonia, *fl. oz.* 2¾, or *Q.S.*; distilled water, *O* 1.
Ammoniæ Fortior.	Chloride of ammonium, *lb.* 3; slaked lime, *lb.* 4; distilled water, *fl. oz.* 32.
Antimonii Chloridi.	Black antimony, *lb.* 1; hydrochloric acid, *O* 4.
Arsenicalis.	Arsenious acid, *gr.* 80; carbonate of potash, *gr.* 80; compound tincture of lavender, *fl. drs.* 5; distilled water, *Q.S.* to make *O* 1; *sp. gr.* 1·009.
Arsenici Hydrochloricus.	Arsenious acid, *gr.* 80; hydrochloric acid, *fl. dr.* 2; distilled water, *Q.S.* to make *O* 1.
Atropiæ.	Atropia, *gr.* 4; rectified spirit, *fl. dr.* 1; distilled water, *fl. drs.* 7.
Atropiæ Sulphatis.	Sulphate of atropia, *gr.* 4; distilled water, *fl. oz.* 1.
Bismuthi et Ammoniæ Citratis.	Purified bismuth, *gr.* 430; nitric acid, *fl. oz.* 2; citric acid, *oz.* 2; solution of ammonia and distilled water, of each *Q.S.*; *sp. gr.* 1·122.
Calcis.	Slaked lime, *oz.* 2; distilled water, *C* 1.
Calcis Chloratæ.	Chlorinated lime, *lb.* 1; distilled water, *C* 1; *sp. gr.* 1·035.
Calcis Saccharatus.	Slaked lime, *oz.* 1; refined sugar, *oz.* 2; distilled water, *O* 1; *sp. gr.* 1·052.
Chlori.	Hydrochloric acid, *fl. oz.* 6; black oxide of manganese, *oz.* 1; distilled water, *fl. oz.* 34.
Epispasticus.	Cantharides, *oz.* 8; acetic acid, *fl. oz.* 4; ether, a sufficiency, makes *fl. oz.* 20.
Ferri Perchloridi.	Strong solution of perchloride of iron, *fl. oz.* 5 distilled water, *fl. oz.* 15.

Ferri Perchloridi Fortior.	Iron wire, *oz.* 2; hydrochloric acid, *fl. oz.* 12; nitric acid, *fl. drs.* 9; distilled water, *fl. oz.* 8; makes *fl. oz.* 10.
Ferri Pernitratis.	Fine iron wire, *oz.* 1; nitric acid, *fl. oz.* $4\frac{1}{2}$; distilled water, *Q.S.*, makes *O* $1\frac{1}{2}$.
Ferri Persulphatis.	Sulphate of iron, *oz.* 8; sulphuric acid, nitric acid, of each *fl. dr.* 6; distilled water, *fl. oz.* 12, or *Q.S.*, makes *fl. oz.* 11.
Hydrargyri Nitratis Acidus.	Mercury, *oz.* 4; nitric acid, *fl. oz.* 5; distilled water, *fl. oz.* $1\frac{1}{2}$.
Hydrargyri Perchloridi.	Perchloride of mercury, chloride of ammonium, of each *gr.* 10; distilled water, *O* 1.
Iodi.	Iodine, *gr.* 20; iodide of potassium, *gr.* 30; dis tilled water, *fl. oz.* 1.
Lithiæ Effervescens.	Carbonate of lithia, *gr.* 10; water, *O* 1.
Magnesiæ Carbonatis.	Sulphate of magnesia, *oz.* 2; carbonate of soda, *oz.* $2\frac{1}{2}$; distilled water, *Q.S.*
Morphiæ Acetatis.	Acetate of morphia, *gr.* 4; diluted acetic acid *min.* 8; rectified spirit, *fl. dr.* 2; distilled water, *fl. dr.* 6.
Morphiæ Hydrochloratis.	Hydrochlorate of morphia, *gr.* 4; diluted hydrochloric acid, *min.* 8; rectified spirit, *fl. drs.* 2 distilled water, *fl. drs.* 6.
Plumbi Subacetatis.	Acetate of lead, *oz.* 5; oxide of lead, *oz.* $3\frac{1}{2}$; distilled water, *O* 1, or *Q.S.*, makes *fl. oz.* 20.
Plumbi Subacetatis Dilutus.	Solution of subacetate of lead, *fl. drs.* 2; rectified spirit, *fl. drs.* 2; distilled water, *fl. oz.* $19\frac{1}{2}$.
Potassæ.	Carbonate of potash, *lb.* 1; slaked lime, *oz.* 12; distilled water, *C* 1; *sp. gr.* 1·058.
Potassæ Effervescens.	Bicarbonate of potash, *gr.* 30; water, *O* 1.
Potassæ Permanganatis.	Permanganate of potash, *gr.* 80; distilled water, *O* 1.
Sodæ.	Carbonate of soda, *oz.* 28; slaked lime, *oz.* 12; distilled water, *C* 1; *sp. gr.* 1·047.
Sodæ Arseniatis.	Arseniate of soda (made anhydrous at a heat not above 300°), *gr.* 4; distilled water, *fl. oz.* 1.
Sodæ Chloratæ.	Carbonate of soda, *oz.* 12; black oxide of manganese, *oz.* 4; hydrochloric acid, *fl. oz.* 15; distilled water, *O* 2.

Sodæ Effervescens.	Bicarbonate of soda, *gr.* 30; water, *O* 1.
Strychniæ.	Strychnia, *gr.* 4; diluted hydrochloric acid, *min.* 6; rectified spirit, *fl. drs.* 2; dist. water, *fl. drs.* 6.
Zinci Chloridi.	Granulated zinc, *lb.* 1; hydrochloric acid, *fl. oz.* 44; solution of chlorine, *Q.S.*; carbonate of zinc, *oz.* ½, or *Q.S.*; distilled water, *O* 1.

Lotions.—These are solutions of medicinal substances for external application. In practice they are very numerous, but they are chiefly prescribed *extempore.* Formulæ for two lotions are, however, contained in the British Pharmacopœia, viz., for black and yellow mercurial lotions.

Lotio.

Hydrargyri Flava.	Perchloride of mercury, *gr.* 18; solution of lime, *fl. oz.* 10.
Hydrargyri Nigra.	Subchloride of mercury, *gr.* 30; solution of lime, *fl. oz.* 10.

Mellita.—There are four formulæ for *Honeys* in the British Pharmacopœia. One is simply for the depuration of honey, the others are for compound preparations somewhat like syrups, the sugar being replaced by honey. *Mel Rosæ* is omitted.

Mel.

Boracis.	Borax, *gr.* 64; clarified honey, *oz.* 1.
Depuratum.	Honey, *lb.* 5; melt in a water-bath, and strain.
Oxymel.	Clarified honey, *oz.* 40; acetic acid, *fl. oz.* 5; distilled water, *fl. oz.* 5.
Oxymel Scillæ.	Vinegar of squill, *O* 1; clarified honey, *lb.* 2.

Misturæ.—There are eleven formulæ for *Mixtures* in the British Pharmacopœia. These preparations are administered either alone or as adjuncts to and vehicles for other medicines. They are so prepared that they may be given in doses varying from half-an-ounce to two ounces.

Mistura.

Ammoniaci.	Ammoniac, *oz.* ¼; distilled water, *fl. oz.* 8.
Amygdalæ.	Compound powder of almonds, *oz.* 2½; distilled water *O* 1.

Creasoti.	Creasote, *min.* 16; glacial acetic acid, *min.* 16; spirit of juniper, *fl. dr.* ½; syrup, *fl. oz.* 1; distilled water, *fl. oz.* 15.
Cretæ.	Prepared chalk, *oz.* ¼; gum acacia, *oz.* ¼; syrup, *fl. oz.* ½; cinnamon water, *fl. oz.* 7½.
Ferri Aromatica.	Pale cinchona bark, *oz.* 1; calumba root, *oz.* ½; cloves, bruised, *oz.* ¼; fine iron wire, *oz.* ½; compound tincture of cardamoms, *fl. oz.* 3; tincture of orange peel, *fl. oz.* ½; peppermint water, *Q.S.*
Ferri Composita.	Sulphate of iron, *gr.* 25; carbonate of potash, *gr.* 30; myrrh, *gr.* 60; refined sugar, *gr.* 60; spirit of nutmeg, *fl. dr.* 4; rose water, *fl. oz.* 9½.
Gentianæ.	Gentian root, *oz.* ¼; bitter orange peel, coriander fruit, of each, *gr.* 30; proof spirit, *fl. oz.* 2; distilled water, *fl. oz.* 8.
Guaiaci.	Guaiac resin, *oz.* ½; refined sugar, *oz.* ½; gum acacia, *oz.* ¼; cinnamon water, *O* 1.
Scammonii.	Resin of scammony, *gr.* 4; milk, *oz.* 2.
Sennæ Composita.	Sulphate of magnesia, *oz.* 4; extract of liquorice, *oz.* ½; tincture of senna, *fl. oz.* 2½; compound tincture of cardamoms, *fl. dr.* 10; infusion of senna, *Q.S.* to make *O* 1.
Spiritus Vini Gallici.	Spirit of French wine, cinnamon water, of each *fl. oz.* 4; the yolks of two eggs; refined sugar, *oz.* ½.

Mucilagines.—There are three formulæ for *Mucilages* in the British Pharmacopœia. They are used to allay irritation of mucous membranes; as vehicles for the combination of oils and resins with water in mixtures and enemata; for suspending insoluble substances, as powders in mixtures; and also for contributing to the constitution of lozenges.

MUCILAGO.

Acaciæ.	Gum acacia, *oz.* 4; distilled water, *fl. oz.* 6.
Amyli.	Starch, *gr.* 120; distilled water, *fl. oz.* 10.
Tragacanthæ.	Tragacanth, *gr.* 60; boiling dist. water, *fl. oz.* 10.

Pilulæ.—There are twenty formulæ for *Pills* in the British Pharmacopœia. The pill is an exceedingly useful form of medicine, and has long existed. It is round, sufficiently cohesive to prevent crumbling, firm enough to retain its shape, dry enough to prevent

its sticking to its neighbours or to the fingers, soft enough to be easy of digestion, from three to five grains in weight, consists of substances that are compatible and that are active in small bulk, and is covered with some vegetable powder, French chalk, magnesia, sugar, silver or gold leaf, or varnish, according to circumstances. Pills are perhaps more frequently prescribed *extemporaneously* and without reference to *officinal formulæ* than any other medicinal form. In constructing a *magistral* pill-formula, the following points are to be considered. The pill is a suitable form:—

1. When the ingredients are active in minute quantities.
2. When the ingredients for each dose do not amount to more than five, or at most six, grains in weight; beyond that the pill becomes a *bolus*, and though the mass were divided into two or more parts, it still remains an obnoxious quantity. There are, however, exceptional cases in which the relative weight of the ingredients, as to their bulk, is such as to allow of a pill weighing six or eight grains without attaining inconvenient size.
3. When a too sudden action of the medicine is to be avoided.
4. When the ingredients are such as cannot conveniently be given in a fluid or more bulky form, whether from the difficulty of suspending them, or from the offensive odour or taste of the active substances.
5. When the ingredients do not cause a rapid change in the pill mass, whether by *deliquescence* or *efflorescence*.

Besides powders and mineral preparations, the more common active ingredients of pills are extracts, resins, gum-resins, balsams, and essential oils.

Having determined upon the active ingredients, the next point is the choice of an *excipient*:—

1. The excipient will be hard or soft, dry or moist, according to the nature of the other ingredients, its chief object being to impart tenacity. Powders and dry substances require a liquid or soft excipient, whilst liquid or moist substances require a dry or absorbent excipient.
2. *Dry Excipients.*—Inert powders, bread crumb, and dry extracts are the chief.
3. *Moist Excipients.*—Water, oils, syrups, honey, treacle, confection of roses, alcohol, tinctures, vinegar, mucilage, soap, soft extracts, &c.

Some excipients soon leave the pills very dry and hard, and are therefore not suitable when the pills are to be kept for some time; others soon give rise to mouldiness. The choice of an excipient is important, therefore, not only with the view of obtaining a due consistency, but also for the preservation of the mass in a plastic and unaltered condition. Sometimes the choice or quantity of an excipient is left to the dispenser, whilst at other times he is obliged to depart from the strict letter of the prescription, because the ingredients ordered are not capable of being formed into a pill. But the physician who has passed through a sufficient course of practical pharmacy is never straitened in his knowledge of what is required to form a suitable medicine, except perhaps occasionally as to some points of a chemical nature, which are only gradually coming to the knowledge of even thoroughly practical pharmaceutists. Sometimes a prescription is written for a single pill, with directions to the dispenser to send a certain number of such to the patient; at other times larger quantities are prescribed to form a mass, with directions to the dispenser to divide the quantity into so many pills. In both instances the latter plan is adopted by the dispenser. Pills have been coated with a variety of substances, with the view of preserving them from the atmosphere, and of protecting the patient from their disagreeable odour and taste, without, at the same time, interfering with their solubility in the alimentary canal. Several substances have been used for this purpose, such as gelatine, collodion, albumen, Canada balsam, white wax, the tinctures of tolu, lac, sandarach, &c. When a sufficient number of pills are sent to a patient to serve for longer than a few days, especially if they contain any fugitive ingredients, they should be sent in well-corked bottles, in which they keep much better than in boxes.

Pilula.

Aloes Barbadensis. Barbadoes aloes, *oz.* 2; hard soap, *oz.* 1; oil of caraway, *fl. drm.* 1; confection of roses, *oz.* 1.

Aloes et Assafœtidæ. Socotrine aloes, *oz.* 1; assafœtida, *oz.* 1; hard soap, *oz.* 1; confection of roses, *oz.* 1.

Aloes et Ferri. Sulphate of iron, *oz.* 1½; Barbadoes aloes, *oz.* 2; compound powder of cinnamon, *oz.* 3; confection of roses, *oz.* 4.

Aloes et Myrrhæ. Socotrine aloes, *oz.* 2; myrrh, *oz.* 1; saffron, *oz.* ½; confection of roses, *oz.* 2½.

Aloes Socotrinæ.	Socotrine aloes, *oz.* 2; hard soap, *oz.* 1; volatile oil of nutmeg, *fl. drm.* 1; confection of roses, *oz.* 1.
Assafœtidæ (Galbani) Composita.	Assafœtida, *oz.* 2; galbanum, *oz.* 2; myrrh, *oz.* 2; treacle, by weight, *oz.* 1.
Cambogiæ Composita.	Gamboge, *oz.* 1; Barbadoes aloes, *oz.* 1; compound powder of cinnamom, *oz.* 1; hard soap, *oz.* 2; syrup, *Q.S.*
Colocynthidis Composita.	Colocynth, *oz.* 1; Barbadoes aloes, *oz.* 2; scammony, *oz.* 2; sulphate of potash, *oz.* $\frac{1}{4}$; oil of cloves, *fl. drs.* 2; distilled water, *Q.S.*
Colocynthidis et Hyoscyami.	Compound pill of colocynth, *oz.* 2; extract of hyoscyamus, *oz.* 1.
Conii Composita.	Extract of hemlock, *oz.* $2\frac{1}{2}$; ipecacuanha powder, *oz.* $\frac{1}{2}$; treacle, *Q.S.*
Ferri Carbonatis.	Saccharated carbonate of iron, *oz.* 1; confection of roses, *oz.* $\frac{1}{4}$.
Ferri Iodidi.	Fine iron wire, *gr.* 40; iodine, *gr.* 80; refined sugar, *gr.* 70; liquorice root, *gr.* 140; distilled water, *min.* 50.
Hydrargyri.	Mercury, *oz.* 2; confection of roses, *oz.* 3; liquorice root, *oz.* 1.
Hydrargyri Sub-chloridi Composita.	Sub-chloride of mercury, sulphurated antimony, of each, *oz.* 1; guaiacum resin, *oz.* 2; castor oil, *fl. oz.* 1, or *Q.S.*
Ipecacuanhæ cum Scillâ.	Compound powder of ipecacuanha, *oz.* 3; squill and ammoniac in powder, of each, *oz.* 1; treacle, *Q.S.*
Plumbi cum Opio.	Acetate of lead, *gr.* 36; opium, *gr.* 6; confection of roses, *gr.* 6.
Quiniæ.	Sulphate of quinia, *gr.* 60; confection of hips, *gr.* 20.
Rhei Composita.	Rhubarb, *oz.* 3; socotrine aloes, *oz.* $2\frac{1}{4}$; myrrh, *oz.* $1\frac{1}{2}$; hard soap, *oz.* $1\frac{1}{2}$; oil of peppermint, *fl. drs.* $1\frac{1}{2}$; treacle, by weight, *oz.* 4.
Saponis Composita.	Opium, *oz.* $\frac{1}{2}$; hard soap, *oz.* 2; dist. water, *Q.S.*
Scillæ Composita.	Squill, *oz.* $1\frac{1}{4}$; ginger, *oz.* 1; ammoniac, *oz.* 1; hard soap, *oz.* 1; treacle, by weight, *oz.* 2, or *Q.S.*

Pulveres.—There are thirteen formulæ for *Powders* in the British Pharmacopœia. Powders are given either because it is desirable that

the medicine should be administered in its integrity, in a form that can be readily attacked by the stomach, and, perhaps, that by simple mechanical action it should produce certain effects; or else, because the substances or the circumstances are not suited to the pill, mixture, or confection forms. The disadvantages attending their use are chiefly their bulk, rendering the dose disagreeable to the patient, that they generally contain a large quantity of inert matter, and that many of them are apt to undergo a deleterious change by keeping. The more minutely powders are divided the more powerful and prompt is their constitutional effect; the coarser they are the more prominent is their topical effect. Powders are either simple or compound; simple when the substance is single, compound when two or more are combined. Compound powders are to be prepared with great care; they should contain no deliquescent substance, and the ingredients should be thoroughly mixed. When they are kept in quantities, they should be occasionally well shaken, because the heavier particles, by frequent concussions of the vessel containing the powders, have a tendency to gravitate, leaving the lighter particles at the top. Powders that contain fugitive ingredients should be sent out in wide-mouthed bottles, well corked or stoppered, leaving it to the patient to apportion the doses; or if it be necessary to dispense such powders separately, they may be wrapped in an outer covering of waxed-paper or tin-foil. Powders that are given in bulky doses, and that are not very active in their operations, may accumulate in the bowels if given for a length of time. To prevent this inconvenience an occasional laxative is to be prescribed.

PULVIS.

Amygdalæ Compositus. (*Confectio, Conserva Amydal.*)	Sweet almonds, *oz.* 8; refined sugar, *oz.* 4; gum acacia, *oz.* 1.
Antimonialis.	Oxide of antimony, *oz.* 1; phosphate of lime, *oz.* 2.
Catechu Compositus.	Catechu, *oz.* 4; kino, *oz.* 2; rhatany, *oz.* 2; cinnamon, *oz.* 1; nutmeg, *oz.* 1.
Cinnamomi Compositus.	Cinnamon bark, cardamom seeds, and ginger, of each, *oz.* 1.
Cretæ Aromaticus. (*Confectio Aromatica.*)	Cinnamon, *oz.* 4; nutmeg, *oz.* 3; saffron, *oz.* 3; cloves, *oz.* $1\frac{1}{2}$; cardamom seeds, *oz.* 1; prepared chalk, *oz.* 11; refined sugar, *oz.* 25.
Cretæ Aromaticus cum Opio.	Aromatic powder of chalk, *oz.* $9\frac{3}{4}$; opium, *oz.* $\frac{1}{4}$.

Ipecacuanhæ Compositus.	Ipecacuan, *oz.* $\frac{1}{2}$; opium, *oz.* $\frac{1}{2}$; sulphate of potash, *oz.* 4.
Jalapæ Compositus.	Jalap, *oz.* 5; acid tartrate of potash, *oz.* 9; ginger, *oz.* 1.
Kino Compositus.	Kino, *oz.* $3\frac{3}{4}$; opium, *oz.* $\frac{1}{4}$; cinnamon bark, *oz.* 1.
Opii Compositus.	Opium, *oz.* $1\frac{1}{2}$; black pepper, *oz.* 2; ginger, *oz.* 5; caraway fruit, *oz.* 6; tragacanth, *oz.* $\frac{1}{2}$.
Rhei Compositus.	Rhubarb, *oz.* 2; light magnesia, *oz.* 6; ginger, *oz.* 1.
Scammonii Compositus.	Scammony, *oz.* 4; jalap, *oz.* 3; ginger, *oz.* 1.
Tragacanthæ Compositus.	Tragacanth, *oz.* 1; gum acacia, *oz.* 1; starch, *oz.* 1; refined sugar, *oz.* 3.

Spiritus.—There are sixteen formulæ for *Spirits* in the British Pharmacopœia. Some of the old spirits are omitted, some are altered in name and character, and a new class is formed, consisting of *Cajuput*, *Camphor*, *Juniper*, *Lavender*, *Peppermint*, *Nutmeg*, and *Rosemary*, made from the Essential oils, in the uniform proportion of one to forty-nine.

SPIRITUS.

		Rect. Spirit.	Sp. Gr.
Ætheris.	Ether, *fl. oz.* 10.	*O* 1.	0·809
Ætheris Nitrosi.	Nitric acid, *fl. oz.* 3. Sulphuric acid, *fl. oz.* 2. Copper wire, *oz.* 2.	*Q.S.*	0·845
Ammoniæ Aromaticus.	Carbonate of ammonia, *oz.* 8. Strong solution of ammon. *fl. oz.* 4. Volatile oil of nutmeg, *fl. drs.* 4. Oil of lemon, *fl. drs.* 6. Water, *O* 3.	*O* 6.	0·870
Ammoniæ Fœtidus.	Assafœtida, *oz.* $1\frac{1}{2}$. Strong solution of ammon., *fl. oz.* 2.	*Q.S.*	
Armoraciæ Compositus.	Horseradish, *oz.* 20. Bitter orange peel, *oz.* 20. Nutmeg, *oz.* $\frac{1}{2}$; proof spirit, *C.* 1. Water, *O* 2.		
Cajuputi.	Oil of cajuput, *fl. oz.* 1.	*fl. oz.* 49	
Camphoræ.	Camphor, *oz.* 1.	*fl. oz.* 9	

		Rect. Spirit.	Sp. Gr.
Chloroformi.	Chloroform, *fl. oz.* 1.	*fl. oz.* 19	0·871
Juniperi.	Oil of juniper, *fl. oz.* 1.	*fl. oz.* 49	
Lavandulæ.	Oil of lavender, *fl. oz.* 1.	*fl. oz.* 49	
Menthæ Piperitæ.	Oil of peppermint, *fl. oz.* 1.	*fl. oz.* 49	
Myristicæ.	Volatile oil of nutmeg, *fl. oz.* 1.	*fl. oz.* 49	
Rectificatus.	Alcohol, with 16 per cent. of water.		0·838
Rosmarini.	Oil of rosemary, *fl. oz.* 1.	*fl. oz.* 49	
Tenuior.	Distilled water, *O* 3.	*O* 5.	0·920
Vini Gallici.	Spirit distilled from French wine.		

Succi.—There are three formulæ for *Juices* in the British Pharmacopœia. Freshly expressed juices of plants were first introduced by Mr Squire thirty years ago; three are now made officinal. In the preparation of juices from fresh plants, the hazard attending the drying of the plant is avoided, and also the dangers which attend evaporation in the process for extracts. To each three parts of the juice obtained by expression, one part of rectified spirit is added to preserve it from decomposition. The juices form an excellent illustration of the influences of climate, soil, and season upon medicinal plants, their value being greatly modified by these causes.

Succus.

Conii. Fresh leaves of hemlock, *lb.* 7; rectified spirit, 1 part to 3 of juice.

Scoparii. Fresh broom tops, *lb.* 7; rect. spirit, 1 part to 3 of juice.

Taraxaci. Dandelion root, *lb.* 7; rectified spirit, 1 part to 3 of juice.

Suppositoria.—There are four formulæ for *Suppositories* in the British Pharmacopœia. Suppositories will be again considered when treating of the various channels by which medicines are introduced into the system.

Suppositoria.

Acidi Tannici. Tannic acid, *gr.* 36; benzoated lard, *gr.* 44; white wax, *gr.* 10; oil of theobroma, *gr.* 90; makes 12.

Hydrargyri. Ointment of mercury, *gr.* 60; benzoated lard and white wax, of each *gr.* 20; oil of theobroma, *gr.* 80; makes 12.

Morphiæ. Hydrochlorate of morphia, *gr.* 6; benzoated lard, *gr.* 64; white wax, *gr.* 20; oil of theobroma, *gr.* 90; makes 12.

Plumbi Composita. Acetate of lead, *gr.* 36; opium, in powder, *gr.* 12; benzoated lard, *gr.* 42; white wax, *gr.* 10; oil of theobroma, *gr.* 80; makes 12.

Syrupi.—There are seventeen formulæ for *Syrups* in the British Pharmacopœia. Some of the old syrups are omitted, and there are, moreover, additions and alterations. The chief difficulties attending the preservation of syrups are their tendencies to ferment and become mouldy if too weak, and to crystallise when too strong. In order to prevent these results, the Pharmacopœia directs, in most cases, that the product of each syrup to be obtained from the ingredients ordered shall be of a certain fixed weight, thus determining at the same time their consistency. Good syrups are of a certain weight in proportion to the ingredients used—of a certain density—are free from crystals and muddiness—are made with the purest sugar—and must be kept in a cool place, and in vessels nearly full. Bottles half-full, or vessels loosely covered, tend to injurious changes through crystallisation of the sugar. When they are to be kept for some time they may be poured into bottles whilst hot, the bottles being immediately well corked and then inverted. Syrups are charged with medicinal substances, and are used either alone for the sake of their active ingredients, or as adjuvants to other medicines, to preserve them, to give them an agreeable flavour, or to promote their activity.

SYRUPUS.

		Refined Sugar.	Product.	Sp. Gr.
Syrupus.	Distilled water, *O* 2.	5lb.	$7\frac{1}{2}$lb.	1·330
Aurantii.	Tincture of orange peel, *fl. oz.* 1; syrup, *fl. oz.* 7.			
Aurantii Floris.	Orange-flower water, *fl. oz.* 8; distilled water, *fl. oz.* 16, or *Q.S.*	3lb.	$4\frac{1}{2}$lb.	1·330
Ferri Iodidi.	Fine iron wire, *oz.* 1; iodine, *oz.* 2; dist. water, *fl. oz.* 13.	28oz.	2lb. 11oz.	1·385
Ferri Phosphatis.	Granulated sulph. of iron, *gr.* 224; phosphate of soda, *gr.* 200; acetate of soda, *gr.* 74; dilute phosph. acid, *fl. oz.* $5\frac{1}{2}$; dist. water, *fl. oz.* 8.	8oz.	*fl. oz.* 12, by measure	

		Refined Sugar.	Product.	Sp. Gr.
Hemidesmi.	Hemidesmus, *oz.* 4; boiling distilled water, *O* 1.	28oz.	2lb. 10oz.	1·335
Limonis.	Fresh lemon peel, *oz.* 2; lemon juice, *O* 1.	$2\frac{1}{4}$lb.	$3\frac{1}{2}$lb.	1·340
Mori.	Mulberry juice, *O* 1; rectified spirit, *fl. oz.* $2\frac{1}{2}$.	2lb.	3lb. 6oz.	1·330
Papaveris.	Poppy capsules, freed from seeds, *oz.* 36; boiling dist. water, *Q.S.*; rectified spirit, *fl. oz.* 16.	4lb.	$6\frac{1}{2}$lb.	1·320
Rhamni.	Buckthorn juice, *O* 4; ginger and pimento, of each *oz.* $\frac{3}{4}$; rectified spirit, *fl. oz.* 6.	5lb. or *Q.S.*		1·320
Rhei.	Rhubarb root, coriander fruit, of each *oz.* 2; rectified spirit, *fl. oz.* 8; distilled water, *fl. oz.* 24.	24 oz.		
Rhœados.	Red poppy petals, *oz.* 13; dist. water, *O* 1, or *Q.S.*; rect. spirit, *fl. oz.* $2\frac{1}{2}$.	$2\frac{1}{4}$lb.	3lb. 10oz.	1·330
Rosæ Gallicæ.	Dried red-rose petals, *oz.* 2; boiling dist. water, *O* 1.	30oz.	2lb. 14oz.	1·335
Scillæ.	Vinegar of squill, *O* 1.	$2\frac{1}{2}$lb.		1·330
Sennæ.	Senna, *oz.* 16; oil of coriander, *min.* 3; distilled water, *O* 5, or *Q.S.*; rectified spirit, *fl. oz.* 2.	24oz.	2lb. 10oz.	1·310
Tolutanus.	Balsam of tolu, *oz.* $1\frac{1}{4}$; dist. water, *O* 1, or *Q.S.*	2lb.	3lb.	1·330
Zingiberis.	Strong tincture of ginger, *fl. dr.* 6; syrup, *fl. oz.* 19.			

Tincturæ.—There are sixty-five formulæ for *Tinctures* in the British Pharmacopœia. Different kinds of spirit are used, as menstrua, in the preparation of the tinctures, according to the solubility of the active principles to be abstracted from the substances from which they are prepared. *Rectified and proof spirits, aromatic spirit of ammonia, and spirit of ether,* are used. Some of the tinc-

tures prepared by the stronger spirits assume a milky appearance when they are diluted with water, the spirit being no longer able to keep the resinous or oily ingredients in solution. To obviate this result, when given in the form of mixture, the addition of mucilage is necessary to suspend the insoluble substances. The method of preparing tinctures has been considerably modified by the British Pharmacopœia, a change which has not given general satisfaction. Before the publication of the Pharmacopœia, there were two rival processes, *maceration* and *percolation*, and there was not a little speculation as to which of these would be adopted. The result has been termed a *compromise.* Fifteen of the tinctures (*marked b. in the following arrangement*) are prepared by the old process of *maceration.* Forty-four of the tinctures (*marked a*) are prepared by a union of the two processes, *maceration* followed by *percolation.* The six tinctures marked *c.* are prepared by simply dissolving the ingredients in the spirit.

British Pharmacopœia Process for the Forty-four Tinctures marked a.—"Macerate for forty-eight hours, with fifteen ounces of the spirit, in a close vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, pour into the percolator the remaining five ounces of the spirit. As soon as the percolation is completed, subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient spirit to make one pint."

Process for the Fifteen Tinctures marked b.—"Macerate for seven days, filter (strain, express), and add sufficient spirit to make one pint," except *Spt. Lavand. Co.*, in which case rectified spirit is added to make two pints.

TINCTURA.

a. Macerate 48 hours and percolate; *b.* Macerate 7 days; *c.* Dissolve in the spirit. Product, O 1. Except *O 2.

		Spirit. Rectified.	Spirit. Proof.
a. Aconiti.	Aconite root, *oz.* 2½.	*O* 1	
b. Aloes.	Socotrine aloes, *oz.* ½. Extract of liquorice, *oz.* 1½.		*Q.S.*
a. Arnicæ.	Arnica root, *oz.* 1.	*O* 1	
b. Assafœtidæ.	Assafœtida, *oz.* 2½.	*Q.S.*	
a. Aurantii.	Bitter orange peel, *oz.* 2.		*O* 1
a. Belladonnæ.	Belladonna leaves, *oz.* 1.		*O* 1

		Spirit. Rectified.	Spirit. Proof.
b. Benzoini Composita.	Benzoin, *oz.* 2. Prepared storax, *oz.* 1½. Balsam of Tolu, *oz.* ½. Socotrine aloes, *gr.* 160.	*O* 1	
a. Buchu.	Buchu, *oz.* 2½.		*O* 1
a. Calumbæ.	Calumba, *oz.* 2½.		*O* 1
b. Camphoræ. Composita. (*Tinct. Opii Camphorata.*)	Opium, *gr.* 40. Benzoic acid, *gr.* 40. Camphor, *gr.* 30. Oil of anise, *fl. dr.* ½.		*O* 1
c. Cannabis Indicæ.	Extract of Indian hemp, *oz.* 1.	*O* 1	
a. Cantharidis.	Cantharides, *oz.* ¼.		*O* 1
a. Capsici.	Capsicum, *oz.* ¾.	*O* 1	
a. Cardamomi Composita.	Cardamoms, *oz.* ¼. Caraway, *oz.* ¼. Raisins, *oz.* 2. Cinnamon, *oz.* ½. Cochineal, *gr.* 60.		*O* 1
a. Cascarillæ.	Cascarilla, *oz.* 2½.		*O* 1
b. Castorei.	Castor, *oz.* 1.	*O* 1	
a. Catechu.	Catechu, *oz.* 2½. Cinnamon, *oz.* 1.		*O* 1
a. Chiratæ.	Chiretta, *oz.* 2½.		*O* 1
c. Chloroformi Composita.	Chloroform, *fl. oz.* 2; Compound tincture of Cardamoms, *fl. oz.* 10.	*fl. oz.* 8.	
a. Cinchonæ Composita.	Pale cinchona bark, *oz.* 2. Bitter orange peel, *oz.* 1. Serpentary, *oz.* ½. Saffron, *gr.* 60. Cochineal, *gr.* 30.		*O* 1
a. Cinchonæ Flavæ.	Yellow cinchona bark, *oz.* 4.		*O* 1
a. Cinnamomi.	Cinnamon, *oz.* 2½.		*O* 1
b. Cocci.	Cochineal, *oz.* 2½.		*O* 1
a. Colchici Seminum	Colchicum seed, *oz.* 2½.		*O* 1
a. Conii.	Hemlock fruit, *oz.* 2½.		*O* 1
a. Croci.	Saffron, *oz.* 1.		*O* 1
a. Cubebæ.	Cubebs, *oz.* 2½.	*O* 1	
a. Digitalis.	Digitalis, *oz.* 2½.		*O* 1

		Spirit. Rectified.	Spirit. Proof.
a. *Ergotæ.*	Ergot, *oz.* 5.		*O* 1
c. *Ferri Acetatis.*	Solution of persulphate of iron, *fl. oz.* $2\frac{1}{2}$; acetate of potash, *oz.* 2.	*Q.S.*	
c. *Ferri Perchloridi.*	Strong solution of perchloride of iron, *fl. oz.* 5.	*fl. oz.* 15. (*sp. gr.* 0.992)	
a. *Gallæ.*	Galls, *oz.* $2\frac{1}{2}$.		*O* 1
a. *Gentianæ Composita.*	Gentian, *oz.* $1\frac{1}{2}$. Bitter orange peel, *oz.* $\frac{3}{4}$. Cardamoms, *oz.* $\frac{1}{4}$.		*O* 1
b. *Guaiaci Ammoniata.*	Guaiac resin, *oz.* 4. Aromatic spirit of ammonia, *Q.S.*		
a. *Hyoscyami.*	Hyoscyamus leaves, *oz.* $2\frac{1}{2}$.		*O* 1
c. *Iodi.*	Iodine, *oz.* $\frac{1}{2}$; iodide of potassium, *oz.* $\frac{1}{4}$.	*O* 1	
a. *Jalapæ.*	Jalap, *oz.* $2\frac{1}{2}$.		*O* 1
b. *Kino.*	Kino, *oz.* 2.	*O* 1	
a. *Krameriæ.*	Rhatany, *oz.* $2\frac{1}{2}$.		*O* 1
b. & c. *Lavandulæ Composita.*	Oil of lavender, *fl. drs.* $1\frac{1}{2}$. Oil of rosemary, *min.* 10. Cinnamon, *gr.* 150. Nutmeg, *gr.* 150. Red sandal wood, *gr.* 300.	*O* 2*	
a. *Limonis.*	Fresh lemon peel, *oz.* $2\frac{1}{2}$.		*O* 1
a. *Lobeliæ.*	Lobelia, *oz.* $2\frac{1}{2}$.		*O* 1
b. *Lobeliæ Ætherea.*	Lobelia, *oz.* $2\frac{1}{2}$; spirit of ether, *O* 1.		
a. *Lupuli.*	Hop, *oz.* $2\frac{1}{2}$.		*O* 1
a. *Myrrhæ.*	Myrrh, *oz.* $2\frac{1}{2}$.	*O* 1	
a. *Nucis Vomicæ.*	Nux vomica, *oz.* 2.	*O* 1	
b. *Opii.*	Opium, *oz.* $1\frac{1}{2}$.		*O* 1
b. *Opii Ammoniata.*	Opium in coarse powder, *gr.* 100; saffron and benzoic acid, of each, *gr.* 180; oil of anise, *fl. dr.* 1; strong solution of ammonia, *fl. oz.* 4.	*fl. oz.* 16.	
a. *Pyrethri.*	Pellitory root, *oz.* 4.	*O* 1	
b. *Quassiæ.*	Quassia wood, *oz.* $\frac{3}{4}$.		*O* 1
b. *Quiniæ.*	Sulphate of quinia, *gr.* 160; tincture of orange peel, *O* 1.		

		Spirit. Rectified.	Spirit. Proof.
a. Rhei.	Rhubarb, *oz.* 2; cardamoms, *oz.* $\frac{1}{4}$; coriander, *oz.* $\frac{1}{4}$; saffron, *oz.* $\frac{1}{4}$.		*O* 1
a. Sabinæ.	Savin, *oz.* $2\frac{1}{2}$.		*O* 1
a. Scillæ.	Squill, *oz.* $2\frac{1}{2}$.		*O* 1
a. Senegæ.	Senega, *oz.* $2\frac{1}{2}$.		*O* 1
a. Sennæ.	Senna, *oz.* $2\frac{1}{2}$; raisins, *oz.* 2; caraway, *oz.* $\frac{1}{2}$; coriander, *oz.* $\frac{1}{2}$.		*O* 1
a. Serpentariæ.	Serpentary, *oz.* $2\frac{1}{2}$.		*O* 1
a. Stramonii.	Stramonium seeds, *oz.* $2\frac{1}{2}$.		*O* 1
a. Sumbul.	Sumbul root, *oz.* $2\frac{1}{2}$.		*O* 1
c. Tolutana.	Balsam of Tolu, *oz.* $2\frac{1}{2}$.	*Q.S.*	
a. Valerianæ.	Valerian, *oz.* $2\frac{1}{2}$.		*O* 1
b. Valerianæ Ammoniata.	Valerian, *oz.* $2\frac{1}{2}$; aromatic spirit of ammonia, *O* 1.		
a. Veratri Viridis.	Green hellebore root, *oz.* 4.	*O* 1	
a. Zingiberis.	Ginger, *oz.* $2\frac{1}{2}$.	*O* 1	
a. Zingiberis Fortior.	Ginger, *oz.* 10.	*Q.S.*	

Trochisci.—There are ten formulæ for *Lozenges* in the British Pharmacopœia. This form of medicine is adopted from the Edinburgh Pharmacopœia. The product in each case is 720 lozenges.

Trochisci. Product, 720 Lozenges.		Refined Sugar. oz.	Gum Acacia. oz.	Mucilage of Gum. fl. oz.	Distilled Water. Quantity. fl. oz.
Acidi Tannici.	Tannic acid, *gr.* 360; tincture of Tolu, *fl. oz.* $\frac{1}{2}$.	25	1	2	1
Bismuthi.	Subnitrate of bismuth, *gr.* 1440; carbon. of magnesia, *oz.* 4; precipitated carb. of lime, *oz.* 6.	29	1	2	(rose water.) *Q.S.*
Catechu.	Pale catechu, *gr.* 720.	25	1	2	*Q.S.*
Ferri Redacti.	Reduced iron, *gr.* 720.	25	1	2	1 or *Q.S.*
Ipecacuanhæ.	Ipecacuanha, *gr.* 180.	25	1	2	1 or *Q.S.*

TROCHISCI— (*Continued*). Product, 720 Lozenges.		Refined Sugar. oz.	Gum Acacia. oz.	Mucilage of Gum. fl.oz.	Distilled Water. Quantity. fl.oz.
Morphiæ.	Hydroch. of morphia, *gr.* 20; tincture of Tolu, *fl. oz.* ½.	24	1	*Q.S.*	½
Morphiæ et Ipecacuanh.	Hydroch. of morphia, *gr.* 20; ipecacuan, *gr.* 60; tincture of Tolu, *fl.oz.* ½.	24	1	*Q.S.*	½
Opii.	Extract of opium, *gr.* 72; tincture of Tolu, *fl. oz.* ½; extract of liquorice, *oz.* 6.	16	2		*Q.S.*
Potassæ Chloratis.	Chlorate of potash, *gr.* 3600.	25	1	2	1 or *Q.S.*
Sodæ Bicarbonatis.	Bicarbonate of soda, *gr.* 3600.	25	1	2	1

Unguenta.—There are thirty-three formulæ for *Ointments* in the British Pharmacopœia. The old *cerates* are either omitted or merged in the ointments, the name having been abandoned. There are several omissions, additions, and alterations amongst the ointments. The consistence of ointments may be modified by altering the quantity of wax or oil, the former giving stiffness, the latter softness, to the preparation. In the dispensing of ointments, the following particulars are to be observed:—1. To reduce the active ingredients to an impalpable state, so that there may be no *grittiness* in the ointment. 2. This reduction may be effected by powdering, if the substance be capable of it, or, otherwise, by dissolving it in a few drops of spirit or other menstruum. 3. To distribute the active ingredients uniformly through the ointment. Ointments are used only externally, sometimes simply as emollients, at other times as vehicles for the most powerful remedies; *e. g. Unguentum Aconitiæ.*

UNGUENTUM.		Prep. Lard. oz.	Simple Oint. oz.
Aconitiæ.	Aconitia, *gr.* 8; rect. spirit, *fl.dr.* ½,	1	
Antimonii Tartarati.	Tartarated antimony, *oz.* ¼,		1
Atropiæ.	Atropia, *gr.* 8; rect. spirit, *fl. dr.* ½,	1	
Belladonnæ.	Extract of Belladonna, *gr.* 80,	1	

		Prep. Lard. oz.	Simple Oint. oz.
Cadmii Iodidi.	Iodide of Cadmium, *gr.* 62, .		1
Cantharidis.	Cantharides, *oz.* 1 ; yellow wax, *oz.* 1 ; olive oil, *fl. oz.* 6.		
Cetacei.	Spermaceti, *oz.* 5; white wax, *oz.* 2; almond oil, *O* 1, or *Q.S.*		
Creasoti.	Creasote, *fl. dr.* 1, . .		1
Elemi.	Elemi, *oz.* ¼, . . .		1
Gallæ.	Galls, *gr.* 80; benzoated lard, *oz.* 1.		
Gallæ cum Opio.	Ointment of galls, *oz.* 1; opium, *gr.* 32.		
Hydrargyri.	Mercury, *lb.* 1; prepared suet, *oz.* 1,		16
Hydrargyri Ammoniati. (*Unguentum Præcip. Albi.*)	Ammoniated mercury, *gr.* 62, .		1
Hydrargyri Compositum.	Ointment of mercury, *oz.* 6; yellow wax, olive oil, of each, *oz.* 3; camphor, *oz.* 1½.		
Hydrargyri Iodidi Rubri.	Red iodide of mercury, *gr.* 16, .		1
Hydrargyri Nitratis. (*Unguentum Citrinum.*)	Mercury (by weight) *oz.* 4; nitric acid, *fl. oz.* 12; olive oil, *fl. oz.* 32, ...	15	
Hydrargyri Oxidi Rubri. (*Unguen. Hydrar. Nitrico-Oxidi.*)	Red oxide of mercury, *gr.* 62 ; yellow wax, *oz.* ¼ ; oil of almonds, *oz.* ¾, . .	1	
Hydrargyri Subchloridi.	Subchloride of mercury, *gr.* 80.		
Iodi.	Iodine, *gr.* 32 ; iodide of potas., *gr.* 32; proof spirits, *fl. dr.* 1,	2	
Picis Liquidæ.	Tar, *oz.* 5; yellow wax, *oz.* 2.		
Plumbi Acetatis.	Acetate of lead, *gr.* 12 ; benzoated lard, *oz.* 1.		
Plumbi Carbonatis.	Carbonate of lead, *gr.* 62, .		1
Plumbi Iodidi.	Iodide of lead, *gr.* 62, . .		1
Plumbi Subacetatis Compositum.	Solution of subacetate of lead, *fl. oz.* 6 ; camphor, *gr.* 60 ; white wax, *oz.* 8; oil of almonds, *O* 1.		
Potassæ Sulphuratæ.	Sulphurated potash, *gr.* 30, .	1	
Potassii Iodidi.	Iodide of potassium, *gr.* 64 ; carbonate of potash, *gr.* 4; distilled water, *fl. dr.* 1, . .	1	

		Prep. Lard. oz.	Simple Oint. oz.
Resinæ.	Resin, *oz.* 8; yellow wax, *oz.* 4,		16
Sabinæ.	Fresh savin, *oz.* 8; yellow wax, *oz.* 3, . . .	16	
Simplex.	White wax, *oz.* 2; almond oil, *fl. oz.* 3, . . .	3	
Sulphuris.	Sublimed sulphur, *oz.* 1; benzoated lard, *oz.* 4.		
Sulphuris Iodidi.	Iodide of sulphur, *gr.* 30, .	1	
Terebinthinæ.	Oil of turpentine, *fl. oz.* 1; resin, *gr.* 60; yellow wax, *oz.* $\frac{1}{2}$, .	$\frac{1}{2}$	
Veratriæ.	Veratria, *gr.* 8; olive oil, *fl. dr.* $\frac{1}{2}$,	1	
Zinci.	Oxide of zinc, *gr.* 80; benzoated lard, *oz.* 1.		

Vapores.

In conformity with a growing impression that inhalation is a mode of administering remedies, more especially for affections of the chest, which is at once agreeable and effective, an entirely new class of formulæ has been introduced into the British Pharmacopœia, fixing the proportions of certain medicinal agents when used for inhalations. Vessels made of stoneware, suitable for this purpose, are now to be procured from most druggists. The formulæ for inhalations, five in number, are—

Vapor.

Acidi Hydrocyanici. Diluted hydrocyanic acid, min. 10-15; water, *fl. dr.* 1.

Chlori. Chlorinated lime, *oz.* 2; water (cold), *Q.S.*

Conii. Extract of hemlock, *gr.* 60; solution of potash *fl. dr.* 1; distilled water, *fl. drs.* 10, min. 20, of mixture on a sponge.

Creasoti. Creasote, min. 12; boiling water, *fl. oz.* 8.

Iodi. Tincture of iodine, *fl. dr.* 1; distilled water, *fl. oz.* 1.

Vina.—There are eleven formulæ for *Wines* in the British Pharmacopœia. The medicated wines hold medicinal substances in solution, and are used much in the same way as the tinctures. Sherry is the menstruum in most of the officinal wines, and the quality of the preparation will depend upon its soundness. It should contain seventeen or eighteen per cent. of alcohol. Orange wine should contain about 12 per cent. of alcohol.

VINUM.

Product $O\,1$. Except Aloes $O\,2$.

		Sherry.	
Aloes.	Socotrine aloes, *oz.* 1½: cardamoms, *gr.* 80; ginger, *gr.* 80,	$O\,2$	digest 7 days.
Antimoniale.	Tartarated antim., *gr.* 40,	$O\,1$	dissolve.
Aurantii.	Wine made in Britain, by fermentation of a saccharine solution, to which the fresh peel of the bitter orange has been added.		
Colchici.	Colchicum corm, *oz.* 4,	$O\,1$	macerate 7 days.
Ferri.	Fine iron wire, *oz.* 1,	$O\,1$	macerate 30 days.
Ferri Citratis.	Citrate of iron and ammonia, *gr.* 160; orange wine, $O\,1$		dissolve, and let stand 3 days.
Ipecacuanhæ.	Ipecacuan, *oz.* 1, . . .	$O\,1$	macerate 7 days.
Opii.	Extract of opium, *oz.* 1, Cinnamon bark, cloves, of each *gr.* 75,	$O\,1$	Do. do.
Quiniæ.	Sulphate of Quinia, *gr.* 20; Citric acid, *gr.* 30; orange wine, $O\,1$		macerate 3 days.
Rhei.	Rhubarb root, *oz.* 1½; canella alba bark, *gr.* 60, ...	$O\,1$	macerate 7 days.
Xericum.	Sherry,—a Spanish wine.		

Besides the general titles of officinal formulæ, others are employed to distinguish certain classes of medicine, such as *Collyrium*, or eye-wash; *Elixir*, a term formerly applied to compound tinctures, *e. g.*, *Paregoric Elixir* (*Tinct. Camph. Comp.*, P. L.), *Elixir Proprietatis* (*Tinct. Aloes Comp.*, P. L.), *Daffy's Elixir* (*Tinct. Sennæ Comp.*, P. L.), &c.; *Emulsion*, a mixture containing oleaginous or resinous ingredients held in suspension by means of yolk of egg, mucilage, or sugar; *Essential Oil*, an oil obtained from odoriferous plants by distillation or expression. There are thirty oils in the British Pharmacopœia, of which twenty-one are distilled, and eight expressed, from vegetable substances, the remaining one being extracted from the fresh liver of the cod by a steam heat, not exceeding 180° F. The term *Julep* is synonymous with *Mistura;* the present *Aqua Camphoræ* was formerly called *Mistura Camphoræ* or *Camphor Julep.*

Linctus is a thin electuary, such as can be *licked* (*lingo*) off the spoon.

Granular Effervescing Powders.—These are a recent invention, and form a distinct class of elegant and useful remedies. They consist of an active medicinal substance in union with the *Citro-tartrate of Soda.* The ingredients, *Citric Acid, Tartaric Acid,* and *Bicarbonate of Soda*, finely divided, are mixed together and heated until by the water of crystallization of the citric acid, the ingredients are converted into a plastic mass. This is dried and granulated by passing it through a coarse sieve. During the operation a part only of the carbonic acid escapes, the remainder being fixed in the solid granular particles, each of which, when dissolved in water, parts with more of the gas, so that when a large quantity of the substance is stirred in water, it gives rise to a brisk sparkling effervescence. Preparations of magnesia, iron, quinine, lithia, &c., have been made in combination with granular effervescing powders.

Granules were first prepared by *Messrs Homolle & Quevenne.* They consist of the more active medicinal substances enveloped in sugar. They are usually made with very active remedies. The *Granules of Digitaline* contain one-sixtieth of a grain of Digitaline in each.

Capsules.—Capsules of gelatine, sugar, or gum are employed to envelop medicines which are apt to create disgust by their odour or taste. Copaiva, cubebs, castor oil, and many other remedies may be so given.

Magistral Formulæ or Prescriptions.

We come now to the consideration of matters with which the physician alone has to do. Hitherto we have had the assistance of the *collector*, the *cultivator*, the *merchant*, and the *dispenser* of drugs. We have been learning from experienced practical teachers how to *select* and *collect* the *Materia Medica* from their sources in nature; how to reproduce certain of them by *cultivation;* how to *preserve* them; how to *prepare* them for use; and, by the ordinances of the British Pharmacopœia, how *to reduce them to forms most convenient for application.* We have been chiefly in consultation with that invaluable physician's friend, the *Pharmaceutical Chemist.* But we have now passed out of his domain: he will still attend to our wants, but he can no longer help us to a decision. Our responsibility is henceforward *undivided.* We are alone with our patient; we have examined him; and, having pronounced his malady, we come to the

momentous question, *Why*, *what*, *when*, and *how* shall we prescribe for him? This quadruple question involves the consideration of several important points, such as:—1. The meaning of the terms *properties*, *forces*, *actions*, and *effects* of *medicines*. 2. The *modus operandi* and *classification* of medicines. 3. The *locality* of the action of medicines. 4. The several methods of *applying* medicines to the patient. 5. The circumstances which *modify* the actions of medicines. 6. *The construction of the Prescription.*

Now, it is plain that to deal with these questions in any beyond the briefest possible manner, would completely change at once the character and usefulness of the *Note-Book;* and that to attempt a brief exposition of the doctrines concerned in them, whilst it would assuredly lead to misconceptions, could be of little or no practical value. I shall therefore give no more than a mere sketch of the subject here, the object of the *Note-Book* being to awaken the student's interest to these important matters, and to show what is to be learned from the lectures and from extended treatises, rather than to supply the details of the subject.

1. The Properties, Forces, Actions, and Effects of Medicines.— All medicines are endowed with *properties* which, when quickened into activity, are called *forces*. The properties and forces of medicines are divisible into three classes:—*a. Physical or Mechanical; b. Chemical; c. Dynamical or Vital.*

We understand by the physical properties of medicines all those qualities by which we recognise them without the aid of chemistry; and of these properties, such as are appreciable by the senses, as form, colour, odour, and taste, are distinguished by the term *sensible*, or, as the French call them, *organoleptic* properties. The chemical properties of substances are those which relate to their composition and to the changes which take place in their constitution by their mutual action upon one another.

The *dynamical* properties of medicines are those by which they produce in the living organism certain effects which are directly referable neither to physical nor chemical force. We have examples of this property in the action of certain inorganic bodies upon each other, of which, perhaps, the action of the magnet upon a steel rod previously destitute of polarity is the simplest illustration. If a steel rod or needle, in which there is no magnetic manifestation, be suspended horizontally from its centre, in such a manner that the suspending agent does not control its movements, the bar or needle may be brought to a state of rest with its extremities pointed in

any direction, and will remain in that position until some external force is applied to overcome its inertia. But if a magnet be passed over the needle from end to end, and the needle be again suspended, we shall find that a change has taken place. It will no longer remain quietly in the position in which it may be placed, as before, but so soon as the force that placed it in any other position is removed, it will spontaneously assume the position of having one of its extremities pointing to the north and the other to the south. But the needle is otherwise the same as before: we can appreciate no physical or chemical change in its constitution; nor can we discover the manifestation of any physical or chemical force in the magnet, and the force which has evidently been in operation is therefore simply called *dynamical* (δύναμις, *power*). So it is also with certain medicines: they are applied to the organism, and a manifest change takes place; but as we can neither refer the change to a physical nor chemical action, we say, in the absence of a more satisfactory explanation, that it is due to the *dynamical* or *vital* properties of the agent.

When a medicine is brought into relationship with the organism, its properties are quickened, its forces come into operation, the *action* of the remedy is manifested, and there follows a series of results which may collectively be termed the *medicinal effect.* This effect is of a twofold character: first, there is the effect produced by the direct contact of the medicine with the part to which it is applied; and, second, there is the result produced by the reaction of the organism as a consequence of the first effect. Effects are also divisible into *Primary* or *Physiological*, and *Secondary* or *Therapeutical.*

Physiological, *Primary*, or *Immediate* effects are the results which may be produced by medicines when applied to the organism during health. But health is not essential to their manifestation; they may arise in the presence of disease, and may either precede or accompany therapeutical effects. Thus, arsenious acid, if given in long-continued small doses, may give rise to a sensation of heat in the *primæ viæ*, nausea, purging, headache, cough, irregularity in the circulation, and many other indications of its presence in the system of a healthy person; and these are physiological effects. But if the person to whom the arsenic was given were suffering from a chronic cutaneous affection—such as *lepra* or *psoriasis*, the physiological effects might still arise, but the chain of events which led to the removal of the disease would constitute the *Secondary* or *Therapeutical* effect.

2. The Modus Operandi and Classification of Medicines.— It has been the desire of every age, as it is still the wish of every individual, to offer some explanation of the manner in which the results proceeding from certain causes are produced. The physician has not been less active in his endeavours than others to trace the footsteps of the cause to its effect. No physician would ever administer a dose of medicine without being able not only to foretell its effects, but also to demonstrate the *modus operandi*—that is, the method pursued by the medicine to fulfil its mission—if he could. No intelligent physician can ever give a dose of medicine without either supposing that he does understand the manner of its operation, or sighing for the explanation. And so strong is the desire of every observant mind to account for the effects witnessed during the treatment of disease, that we can scarcely be surprised at the numerous attempts that have been made, from time to time, to offer some reasonable explanation of the conduct of medicines during their presence in the human system. Some of these explanations have been mere assumptions, conclusions hastily drawn, for the sake of offering a plausible interpretation of certain phenomena—they are mere *hypotheses;* whilst others, founded upon philosophical principles, deserve the dignity of *theories.*

The actions of medicines have been referred to their physical, chemical, and dynamical or vital properties. By their physical and chemical properties, medicines may act in the living organism in the same way as they would act upon each other, under favourable circumstances, apart from living beings ; but when it is said that medicines act *dynamically*, it is meant that they produce their effects by an unexplained influence over *vitality*, either by increasing, diminishing, or otherwise altering the powers of life. But the action of a medicine, it is said, may be of a compound character : it may be partly physical, or partly chemical, and partly dynamical or vital ; and the action is then termed either *physico-vital* or *chemico-vital*, as the case may be. And when the action is in no way referable either to the physical or chemical force, it is said to be *purely vital.*

When we consider this complex subject at length, however, we shall find that not one of the theories offered in support of these assertions has been sufficient to afford a universal explanation of the actions of remedies. Many of them, it is true, are still unrefuted, and even now afford plausible explanations of the *modus operandi* of certain medicines ; the chief objection urged against them being,

not that they are altogether unreasonable and improbable, but that they are individually pushed too far. But not only has no single theory satisfied the intense desire for an explanation of the actions of medicines, but even the sum of all the theories leaves still a want which neither experience nor speculation has hitherto been able to supply. Nor is it surprising, when we consider the inconstancy of the grounds of argument. It is a very difficult matter to found a satisfactory theory upon the basis of individual experience; for even during a long life of careful observation, the physician can scarcely expect to accumulate a sufficient number of cases, in all respects identical, upon which he can establish a definite *law* or *principle*. The experience of ages has failed in this; and the accumulation of statistics, however numerous, unless they be, as indeed they scarcely can be, in all respects identical, will never reduce the science of therapeutics to exactness. It is the vital element—the ψυχὴ, πνεῦμα, *archæus*, *anima*, vital principle, call it what you please—that is the disturbing cause in all such calculations of the physicist, the chemist, and even of the vitalist; and so long as that remains beyond human control, there can be no absolute certainty in the practice of medicine.

One of the most difficult points that the physician has to determine at the bed side, is the exact effect of a medicine. A certain drug was administered yesterday, a certain change is observable to-day; is the change wholly, partly, or at all due to the medicine? One of the chief sources of fallacy in the practice of medicine is the ready application of the *post hoc, propter hoc* argument; a medicine has been given, a change follows, *therefore* the medicine *caused* the change. It is to this readiness to call mere sequences *effects* that we owe the short-lived remedies which occasionally startle the world as by a flash and a loud report, and then gradually vanish like the smoke of a cannon. But if it be a difficult matter to recognise the results of the medicine *after*, how much more difficult must it be to predicate its effects *before*, its administration. In his *Essay on the Human Understanding*, John Locke affords the following illustration of the *iatro-mathematical* speculations. Reviving an old physical doctrine, he says—" If we could discover the figure, size, texture, and motions of the minute constitutional parts of any two bodies, we should know, without trial, several of their operations one upon another, as we do now the properties of the square or a triangle. Did we know the mechanical affections of the particles of rhubarb, hemlock, opium, and a man, as a watchmaker does those of a watch, whereby it performs its operations, and of a file, which, by rubbing on them, will

alter the figure of any of the wheels, we should be able to tell beforehand that rhubarb will purge, hemlock kill, and opium make a man sleep." Very true, if the file, wheels, rhubarb, hemlock, opium, and man were alike simple and steadfast in constitution; but they are not. The wheels of the watch and the file are constant and unchanging mechanical implements, having the same "affections" from day to day and year to year; whereas the mechanical and chemical "affections" of rhubarb, hemlock, and opium, and the mechanical, chemical, and, above all, the *vital* "affections" of the man are ever changing, and are in no two individuals alike. The same file will affect fifty different wheels in exactly the same manner, if applied in all cases alike, and fifty files applied equally to one wheel will produce identical effects. But the same sample of opium may affect fifty different individuals in as many different ways, according to the age, sex, development, temperament, idiosyncrasy, conditions of organs and their functions, the presence of disease, and other modifying causes present in each case; and it may, moreover, affect the same individual in different ways, according to the predominance of one or other of the above circumstances at different periods of life. And again, if fifty doses of opium were given, in succession, to one individual, from samples of the drug prepared under as many different circumstances of climate, soil, elevation, season, mode of collecting, &c., each dose might produce a different effect. Man is not a machine, to be operated upon as a watchmaker deals with a watch. When the watch stops, the watchmaker can readily enough replace the broken spring, and set it in motion again; but the springs of life are of Divine origin, not of human manufacture. The heart beats and the lungs breathe, unaided by a single human thought, and when their movements cease, no human power can revive them. Analogy offers at best but a feeble support to the doctrines of the actions of medicines, even when it is drawn from experiments made upon the lower animals; but it is utterly inadequate when it compares the highest of God's creatures with the ordinary products of that creature's workmanship—animated beings with things inanimate. No comparison of a man with a watch, or a steam-engine, can constitute a proof of the silent and invisible changes which occur in the human frame; nor can any results obtained by manipulations in the workshop of the mechanic, or the chemical laboratory, be accepted as serious indications of the treatment proper to the vital economy.

But we have also another important element to consider in re-

ference to the organism: Suppose, for the sake of brevity, we speak of disease as *disordered vitality*, then we find that there exists in the organism itself an innate tendency to the *restoration of order*, by means of a force which we call *vis medicatrix naturæ*—the *healing power of nature.* Most physicians pay great deference to this force; but in pursuing this course, the vitalists have often gone as far wrong as the physicists and the chemists. The indications of nature are, doubtless, of the utmost value, and the Latin phrase is probably near the truth, that says *medicus curat, natura sanat morbos*—the physician *cures*, that is, takes care of the patient, in the sense, if we may use analogy, in which the pilot takes care of a vessel in a storm, but nature *heals* the disease. What, perhaps, is most wanted, in the present state of Therapeutics, is a combined effort on the part of physicians to ascertain, by means of extensive and accurate observation, how far the unaided efforts of nature are capable of restoring to health, or, in other words, what is the *natural history* of diseases. If anything approaching to scientific accuracy were ever effected in this direction, it would be then comparatively easy to judge correctly regarding the value of any particular medicine or mode of treatment. But in the present state of our knowledge we are not warranted in adopting the exclusive doctrines of Hippocrates or of Hahnemann. We owe a deep debt of gratitude to the zealous labourers in this department of medical investigation; but even they would scarcely ask the student to commit himself at once to their doctrines, and to receive them as the unchallenged expositions of the actions of medicines. All that can be demanded of him is, that he shall give them his careful consideration, reserving the expression of his opinions regarding them for maturer years, when credulity and scepticism, after many a conflict, shall have found a common level in his mind. In the lectures devoted to this part of the subject, we review the doctrines of the various schools; but they are too bulky to admit of being placed in the *Note-Book.* And here I would only further add a single caution to the student against the hasty acceptance of speculations, whether of the physicist, the chemist, or the vitalist, which, from an acquaintance with but the two ends of the chain—the initial cause and the ultimate effect—profess to solve the mystery of those intervening links which lie hidden in the recesses of the vital economy.

Seeing that the actions of medicines are not fully understood, it is obvious that no trustworthy *classification* can at present be established upon the basis of their *modus operandi.* To a certain

extent, perhaps, this most desirable method of classification may be available; but until much that is now obscure with respect to the actions of medicines be brought to light, its use must necessarily be very limited. Nevertheless, a classification of some kind is necessary. We can readily conceive the difficulty that would be constantly felt in a large library, in which the books were placed at random upon the shelves, without reference to number, name, or subject. To facilitate the consultation of books various plans are adopted: they may be arranged alphabetically according to the names of the authors, or according to the titles of the books; or they may be classified according to the subjects treated of—*history* here, *geography* there; here *biography*, there *novels*, and so on.

So it is also with medicines. To place them at random upon the shelves of the pharmaceutist, or to treat of them in a disorderly manner in books, would cause great confusion and loss of time in searching for individual remedies; whilst, at the same time, the memory would be clumsily overloaded, and many useful medicines would, from time to time, fall out of mind, and be lost on the journey of life. To obviate such difficulties, medicines have been arranged in classes, according to the views entertained of the relative value of classifications by the different writers on Materia Medica. Almost every writer on the subject has his own peculiar classification, either entirely novel or merely an emendation upon the arrangement of a previous author. Hence, there is a great variety of classifications, none of which, however, is perfect, because the basis of the classification is in no instance adapted to the whole list of Materia Medica; whilst, on the other hand, few, if any, medicines can be restricted to a single class. And so we find, upon comparing the classifications of different authors, that the classes which are adopted by some are ignored by others; and that even those classes which have received general adoption are frequently represented in the various works by different medicines.

In some works the medicinal substances are arranged simply in alphabetical order, like the words in a dictionary. This plan, like the rest, has its advantages and disadvantages. It is a convenient form for consultation, because the book can be opened at the place where the substance is to be found, without reference to an index. In works thus arranged, we generally meet with a definite, concise, and exhaustive account of the substance in one spot, and are spared the annoyance of frequent references to other parts of the work. The disadvantages are, chiefly, that it prevents continuous reading, whilst it does not in all cases supersede the necessity for an index,

seeing that medicines possessed of several names can only be classified by one of them.

In other works, the classification is made with reference to the physical properties of medicines, obviously a very imperfect plan. One of the conceits of the physicists was, that every medicinal substance afforded, in one or another of its external characters, an indication of its therapeutic value, and a guide to its exhibition. In this hypothesis originated the absurd *Doctrine* of *Signatures*, the promoters of which maintained that every medicinal substance presented in one of its sensible properties a likeness to some part of the organism, that these similarities were the results of *astral* influences, and that such relations of colour, shape, &c., were trustworthy indications of the applicability of the medicine to the diseases of the part which it resembled. Each of such marks or characters was called a *signature*. Thus, the root of the *mandrake* was recommended as a cure for sterility, because of its supposed resemblance to the human form; *turmeric* was a cure for jaundice, because of its yellow colour; *poppies* for diseases of the head; *aristolochia* for uterine diseases, and so forth; whilst a covering of red cloth, being the same colour as the blood, served to attract that fluid to the surface of the body.

But even more recently the sensible qualities of medicines have been proposed as indications of their therapeutic value, and classifications of medicines have been made according to their colour, taste, and smell. That substances which are allied by taste, or smell, or both, are frequently also alike in medicinal action, is undeniable; bitter substances are generally used as tonics; substances with a fetid odour are often used as antispasmodics; sweetish mucilaginous substances as demulcents; harshly tasting substances as astringents; and hot-tasting substances as carminatives. With respect to colour we have no well-marked classes. Other therapeutic indications are held to exist in the form, weight, &c., of remedies; as examples of which are quoted the hairs of the pods of *Mucuna pruriens*, silica, glass, the woody fibre of vegetable substances given in bulk, quicksilver, the class of demulcents, &c. We should, however, scarcely adventure a couple of drachms of sulphate of zinc, or of oxalic acid, merely because these compounds are not unlike Epsom salts; nor, in short, should we be justified in the use of any untried substance, simply from an acquaintance with its sensible properties.

Still another method of classification upon physical or mechanical principles remains to be adverted to; namely, that which is based

upon the theory of the *modus operandi* of medicines by their influence upon the *osmotic force.* It is supposed that there are certain medicines which act by controlling the transference of fluids through living animal membranes, either by altogether preventing the passing of the fluids, or by determining the intensiy of the *endosmotic* or *exosmotic* current. If this idea be well founded, it becomes a matter of the deepest importance, seeing that life itself is sustained by a regular interchange of nutrient and effete matters, conducted through intervening membranes by means of the physico-vital process of *osmosis.* This question is intimately related to that of *absorption,* and requires more space for its elucidation than the *Note-Book* allows.

Again, affinity of botanical characters has been proposed as an indication of similarity of medicinal virtues. This analogy may certainly be traced to a considerable extent, but it is by no means a safe guide, and no physician would be justified in administering an untried remedy, on the sole ground that it was derived from a family containing several useful medicinal plants. The umbelliferæ are generally harmless, yet the order contains hemlock, a most deadly poison; the Solanaceæ, even when separated by a more accurate botanical analysis from the Atropaceæ, with which they used to be classified, still contain the potato, a valuable and nutritious esculent, and, alongside of it, the bitter-sweet, an active poison; and we would err very far did we administer aloes, squill, and asparagus indiscriminately, because they are all derived from the natural family *Liliaceæ.* Moreover, substances possessed of identical medicinal properties may be collected from different natural families, such as digitalis (*Scrophulariaceæ*), tobacco (*Atropaceæ*), and lobelia (*Lobeliaceæ*), which are all depressents.

Again, the chemical relations of substances have been proposed as indications of their therapeutic value; but here, too, we shall find that the exceptions so far outnumber the instances upon which the law is based, as to render this mode of classifying medicines also well-nigh practically useless. There is, however, something far more intricate and subtle about the chemical than about the physical relations of substances, and this we may pause for a moment to inquire into. The important differences to be observed between the physical and chemical forces are chiefly these: that whilst the physical force can be manifested both in similar and dissimilar bodies, the chemical force can be developed only between dissimilar bodies; and that, whilst the physical force does not, as a general rule, permanently alter the properties of the bodies subjected to its influence, the

chemical force generally produces a permanent change. And it is important to remember especially one point with reference to the chemical force in relation to medicinal substances; namely, that we cannot foretell the result of its manifestation. Bodies, either elementary or compound, which might be administered alone with impunity, may, if given together, in consequence of the manifestation of the force of *chemical affinity*, produce most disastrous results. The elementary bodies, carbon, hydrogen, and nitrogen, for example, may be applied to the organism individually, within certain limits, without producing any injurious effects; and in various combinations they enter into the human constitution. Judging by the individual characters of these elementary bodies, we could not possibly infer that they were able to assume a form in which they are capable of destroying life, even when exhibited in exceedingly small quantity. No mere mechanical mixture could effect this change; but we know from experience, that by *chemical affinity* these elements can assume the form of HCN, one of the swiftest and most destructive poisons, *prussic acid*. Carbon, hydrogen, nitrogen, and oxygen, which are in themselves comparatively harmless bodies, assume very different characters, according to the relations which they bear to each other when influenced by chemical affinity. The following chemical formulæ are not very unlike each other, they are constituted of the same elements, and differ only in the number of atoms of each—$C_{21}H_{22}N_2O_2$; $C_{17}H_{19}NO_3H_2O$; $C_{20}H_{24}N_2O_2$; $C_{32}H_{52}N_2O_8$—and yet how different are their medicinal properties; the first represents *strychnia*, the second *morphia*, the third *quinia*, and the fourth *veratria*. Moreover, substances which are alike not only in the number, but also in the proportions of their constituents, may differ widely in their medicinal and physical as well as their other chemical properties: thus the formula $C_{10}H_{16}$ represents equally the oils of turpentine, lemons, oranges, bergamot, chamomile, cloves, thyme, and many others. *Isomerism* (*ἴσος*, *equal*, *μέρος*, *part*) is no greater proof of identity of medicinal properties than *isomorphism* (*ἴσος*, *equal*, *μορφή*, *form*). Substances which are made up of constituents alike in quality and quantity, may differ widely in their properties, according to their molecular arrangement. By analysis, we can ascertain the number and proportion of the elementary constituents present in a substance, but not the form in which the molecules are arranged; chemistry has not yet revealed this mystery in the economy of nature.

It must be obvious, therefore, even from the few examples quoted,

that the proposition to judge of the medicinal activity of substances simply by their physical or chemical properties cannot be sustained to any great extent. Neither *isomerism* nor *isomorphism*, neither similarity in constitution nor likeness in form, can enable us unexceptionably to foretell the action of a medicine, even upon purely chemical or mechanical principles, supposing all other circumstances to be constant; much less will it enable us to foresee the nature of the effects that will be produced under the influence of the compound *chemico-vital* or *physico-vital* forces. But, on the other hand, in favour of chemical classifications, it is to be borne in mind that there are certain analogies of chemical properties and medicinal actions which cannot be overlooked. We have examples of these in the mineral and vegetable acids; in the *halogens*, iodine, chlorine, and bromine; in the alkalies, potash, soda, and lithia; in the alkaline earths, magnesia, lime, baryta, and strontia, &c.; but even in these instances the *identity* is not equal to the *diversity* of medicinal action.

Again, medicines have been classified according to the parts of plants or animals from which they are derived, an arrangement that has been but little respected.

Again, medicines may be classified according to their physiological and therapeutical action upon the lower animals, as ascertained by observation or experiment. Of all the plans hitherto mentioned this is by far the most trustworthy, because in it, for the first time, the vital element is brought into operation. But still it would be very unsafe to administer a substance to a human being upon no better authority than that it had previously been applied to a horse, a dog, or a rabbit, with benefit or impunity. Sheep, goats, and cows eat the leaves of *hyoscyamus niger* with impunity. Enormous quantities of arsenic, tartar emetic, and belladonna have been given to horses without producing untoward effects. Albers gave morphia and opium to rabbits in doses that would have destroyed several human beings, but they produced no narcotic results. The anatomical differences between man and the lower animals are quite sufficient to nullify the actions of medicines in the latter as criteria of their effects upon the former. Nevertheless, observations and experiments made upon the lower animals are of great value, for by them many facts have been ascertained with respect to the conduct of different medicines, and of the same medicine under different circumstances, in the animal economy, which could not have been elicited by experiment upon human beings.

Of the methods now mentioned, it may be stated that, neither individually nor collectively, are they sufficient to constitute a sound basis for the classification of medicines, nor trustworthy indications of the actions and effects of medicinal substances in the human system. Like the symptoms of disease, each has a relative significance which may, and ought to be, duly estimated, but singly cannot be relied on.

Then, finally, medicines may be classified according to their physiological and therapeutical actions in the human system. These are the only satisfactory methods of classification, and they are still very deficient. We cannot enter here into these questions, because they involve all the considerations of the actions of medicines; but this may be said, that even when these most desirable classifications are constructed, they must necessarily give rise to many exceptions, varying not only with the *individuality* of the patient, but also with the characters of the disease. The action of a medicine upon a person in health cannot be accepted as the criterion of its action in the presence of disease; nor can the action of a medicine be certainly predicated in any individual case. It may be modified by many circumstances, pertaining equally to the patient and the drug itself, as we shall show more fully hereafter. And again, medicines are not to be restricted to a single class, for they act in a variety of ways, according to the manner in which they are administered: thus, tartar emetic may be a diaphoretic, expectorant, or emetic; quinine, tonic, or a febrifuge; calomel, an alterative, a cathartic, or a sialogogue; squill, an emetic, cathartic, diuretic, or expectorant; or all may be given as poisons.

Medicines may be classified physiologically, either according to effects which are obvious, or according to the changes which they are supposed to produce within the system, but of which there is no immediate external manifestation. Of the former, we have an instance in that comprehensive class called *evacuants*, comprising substances which cause discharges from one or other part of the body: if from the skin, they are *diaphoretics;* if from the nose, *errhines;* if from the bowels, *cathartics;* if from the lungs, *expectorants.* Of the latter we have examples in *alteratives* and *tonics.*

It is easier to classify medicines physiologically than therapeutically, because it is easier experimentally to trace the cause of aberration than that of restoration. The natural condition of the body is health—a state, it is true, that cannot be maintained without a due attention to the necessities of life, but which, nevertheless, under

favourable circumstances, is its normal state; whilst disease is a departure from the normal condition, and is caused either by a positive injury, as by a stroke or a poison, or by deprivation, as of food, heat, light, exercise, &c. But there is always a tendency, sometimes feeble and unavailing, but invariably present—the *vis medicatrix naturæ*—an innate tendency to return to the normal condition of health; and it is the conflicting influence of this *healing power of nature* that renders a therapeutical classification the more difficult.

No medicine is worthy of a place in either of these classifications until it has repeatedly, and under a variety of circumstances, manifested its qualifications; and these are more readily tested physiologically than therapeutically. An illustration will explain this more clearly. A medicine is administered to a person in health, and soon afterwards it is observed that his pulse beats less rapidly than before; the dose is repeated, and the pulsations are still slower. The experiment is frequently repeated under a variety of circumstances, and upon several persons of different qualities, and the result is invariably a reduction in the number of pulsations. Such a medicine may then be fairly classed with *arterial sedatives.* Again, the same medicine is administered as frequently to the same number of persons, all suffering from acute inflammation and an abnormally rapid circulation. A reduction in the rate of arterial pulsation follows; but in this case the proof of the sedative influence of the medicine is not so strong, simply because it is in the direction of, whereas in the former case it was opposed to, the tendency of nature. Or, to take another illustration: suppose a ball to be hanging quiescently at the end of a string, and it is desired to prove that two instruments, when alternately brought near to it, have an opposite effect upon it, the one gradually setting it in motion, the other gradually bringing it to a state of rest. By repeatedly observing the fact, that on the approach of one of the instruments the ball begins to move, at first gently, and then more rapidly, we should conclude that the instrument was the cause of the motion. But of the influence of the second instrument to bring the ball gradually to a state of rest, we should be more doubtful, simply because, if left alone, the ball would of itself become quiescent. In the one case, the proof is positive, in the other negative. Nevertheless, we are not to despair of attaining a therapeutical classification. We shall not arrive at it by mere speculation, not by *ex parte* chemical, physiological, or pathological theories, but by close practical observation. All our trustworthy remedies have been introduced and confirmed clinically, experimentally, or, if you will, empirically, and not hypothetically. Practical therapeutics

can be studied only at the bedside, where alone the student, aided by chemistry, physiology, and pathology, can learn to be a wise and prudent physician. The trustworthy practitioner is the chemist, physiologist, pathologist, therapeutist, all in one; it is only when the mere man of science approaches the bedside that we encounter those specious, and often captivating, speculations, which have hitherto retarded, rather than promoted, the practice of medicine.

3. The Locality of the action of Medicines.—When a medicine is applied to the organism, its action may be manifested either at the point of contact, or at a distant part of the body, or in both places. When the action of the medicine is developed at the point of contact, it is said to be *topical* or *local;* when at a distant part, it is said to be *remote.* The topical action of a medicine is modified chiefly by two circumstances, the quality and state of aggregation of the medicine, and the sensibility, and qualities of the secretions, of the part to which it is applied. A medicine may exhibit a topical and no perceptible remote action; or contrariwise, a remote action without any perceptible local effects.

Various explanations have been urged as to the manner in which medicines produce their remote effects. The chief are these: *By absorption into the circulation, by nervous agency or sympathy, by contiguity of organs, by continuity of tissue, and by revulsion;* and doubtless, to a limited extent, medicines may manifest their remote action through any of these channels; but greater interest attaches to the two former methods—the nervous agency and the circulation—for it is between the supporters of them that the keenest controversies have arisen. The majority of medicines probably exercise their remote effects by being absorbed into the circulation, by means of the veins, and, to a less extent, by the lymphatics and lacteals; but there are some medicines whose remote effects may be due partly or entirely to nervous agency.

It is probable that no solid particles can be taken into the circulation; and, therefore, it is generally stated that medicines to be absorbed must be either given in a state of solution, or must be capable of solution in the secretions of the alimentary canal, or other parts to which they are applied. They must be soluble, too, without decomposition; or if decomposition takes place, the resulting compounds must be capable of producing the desired effects. The agents by which medicines, administered in a solid form, may be rendered soluble, or by which they may be otherwise operated upon, when administered in the usual way by the digestive apparatus, are the *acids, alkalies, alkaline chlorides,* and other peculiar principles of the gastric and intestinal juices.

4. Channels by which Medicines are introduced into the System —All parts of the body are capable of absorbing medicinal substances, but not with equal energy and rapidity. And, moreover, the several tissues to which medicines are applied, exercise, through their secretion, a modifying influence upon the remedies. Medicines may be introduced through mucous membranes, skin, and subjacent cellular tissue, serous membranes, wounds, and vessels.

Mucous Membrane.—Of this there are two tracts:—1. In relation with the eyes, ears, nose, pulmonary apparatus, and alimentary canal. 2. Genito-urinary.

1. *The Gastro-enteric, Pulmonary, &c., tract of Mucous Membrane.*—Of the larger tract, the mucous membrane of the stomach and intestines is most frequently used for the exhibition of medicines, chiefly on account of the facility of the application, the readiness with which absorption takes place, and the intimate relationship between these parts and the rest of the body. But the stomach may be rendered unavailable by obstinate refusal or inability to perform the act of deglutition, by obstinate regurgitation or vomiting, arising from irritability of the membrane or more serious disease of the organs, by antipathy or repugnance, by the production of some untoward physiological result, or by the action of the gastric fluids rendering the medicine inert. Moreover, it is sometimes necessary to approach the system by two avenues at once, as by simultaneous internal administration and inunction, &c.

The mucous membrane of the rectum and colon being less capable of absorption, and less sympathetic in its relations than that of the stomach and smaller intestines, is also inferior as a channel for the introduction of medicines. Nevertheless, when, from the above-mentioned causes, the mucous membrane of the upper part of the alimentary canal is unavailable, medicines may be applied with advantage by the rectum. There are, moreover, cases in which, independently of such obstructions, this part of the canal is preferable. Medicines are applied to the rectum both for local and remote purposes, such as to soothe the part, to remove irritating substances and promote defæcation, or to relieve a distant part by revulsion. The neighbouring organs, as the bladder and the uterus with its appendages, are also often more readily affected through the rectum. Very frequently the pain arising from an inflammatory affection of the uterus, its appendages, or of the bladder, is relieved immediately by an opiate suppository; whereas opiates administered by the mouth exerted little or any effect.

Differences of opinion exist as to the relative quantity of medi-

cine to be given by the rectum; the absorbent powers being less, some have said that the dose might be as much as four or five times greater; whilst others, on the contrary, have decided, that of certain medicines less is to be given by the rectum than by the stomach. The preponderating opinion, however, seems to be that, as a rule, between two and three times more may be given by the rectum than by the stomach. Medicines administered by the rectum are of two forms, solid and liquid, *suppositories* and *enemata*. *Suppositories* are usually of conical shape, from one to two inches in length, and never exceed the little finger in size at the base. They are lodged in the rectum, and are intended either to soothe or cause local irritation, to affect the system generally, to react upon neighbouring organs, or to act as purgatives. Cacao butter forms, perhaps, the most frequently employed vehicle for suppositories, though gelatine has lately come into pretty general use in their preparation. *Enema*, (*Clyster*, *Glyster*, *Lavement*)—This is either a simple fluid, as water, or one containing medicinal or nutrient ingredients, thrown into the rectum and colon. Enemata are generally intended to produce local effects; but sometimes by causing irritation, or by being absorbed, they influence remote parts. Their object may be to remove irritating substances and accumulations from the rectum, to act as purgatives, or to soothe or irritate the rectum and organs in its vicinity, for a variety of purposes. The substance to be introduced is determined by the nature of the case; the quantity is determined by the object to be attained and the age of the patient. If the enema is to remain, it should be introduced as quietly as possible, should be small in quantity and of medium temperature, because if bulky, cold, or violently injected, it will cause forcible contraction of the gut and its own expulsion. If the enema is to be retained, it should not exceed half-an-ounce for a child, nor two ounces for an adult. Otherwise, for a child under five years, three or four ounces; from ten to fifteen years, six to eight ounces; and for an adult, rarely exceeding sixteen ounces. An infant requires about one ounce. Care must be taken, in applying the instrument, not to injure the parts; the pipe should be previously oiled or greased, and when insoluble and irritating medicines are injected, they should be suspended in some bland mucilaginous vehicle. Gaseous substances have been injected into the rectum, but this practice is now seldom resorted to. The frequent employment of enemata often leads to deplorable results, and patients should be cautioned against their habitual use.

The mucous membrane of the mouth, throat, and nose is seldom

used for the application of medicines, except for local purposes; but mercurial and auric preparations have been rubbed into the gums, to produce constitutional effects. *Sternutatories* or *ptarmics* cause sneezing, and *errhines* produce discharges, when applied to the pituitary membrane. *Masticatories* are used as solid local applications to the cavity of the mouth, and *washes* or *collutoria* as fluid applications. *Gargles* are applied to the pharynx and tonsils. For arresting the hemorrhage in epistaxis, a variety of substances are injected, and, finally, *plugging the nostril* is resorted to in severe cases. *Condiments* are used chiefly to quicken the appetite. The *conjunctiva* is used only for local purposes. *Eye-washes, eye-water*, or *collyria*, are liquid applications containing medicinal substances; they are either stimulants or sedatives, astringents or escharotics, according to the circumstances of the case. Applications to the conjunctiva should be made with extreme caution, for irreparable mischief may be done by their abuse. Lead collyria should be avoided where the conjunctiva is broken, otherwise a permanent opacity may result.

Medicines are occasionally applied to the *Eustachian membrane* for local purposes, but this practice should be followed with extreme caution; and medicinal applications even to the *meatus auditorius externus* are not to be made indiscriminately.

The membrane lining the air passages is very susceptible, and medicines applied to it act powerfully, as they are exposed to an exceedingly large absorbing surface. Formerly, this membrane was much more frequently used for the administration of medicinal substances than it is at present. The practice of *inhalation* and *fumigation* is chiefly confined to local purposes, as for the relief of distressing symptoms in chronic bronchitis, asthma, phthisis, &c.; but it is also employed to induce general anæsthesia, and as a channel for the introduction of stimulants, such as the vapour of ammonia, aromatic vinegar, &c. Impalpable powders and powerful gases are rarely exhibited by this method now, though formerly much vaunted. Aqueous vapour, either alone or charged with some medicinal substance, is often inhaled with advantage in affections of the air passages, a process which may be readily effected by holding the head over a basin of hot water, by cautiously inhaling it from the spout of a lightly covered teapot, or by the use of one of the many instruments invented for the purpose. Fumes for inhalation are created in a variety of ways, as by saturating paper in a solution of the medicine, and, when dry, burning it in the sick chamber, or

by throwing medicinal substances upon hot coals, and directing the fumes into the room. Medicated *cigars* and *cigarettes* are also used. Dr Corrigan invented an instrument for the exhibition of medicated vapours, an account and representation of which is to be found in the "Dublin Medical Journal," vol. xv. The object of this, as it should be of all similar instruments, is to afford the following facilities for a fair trial of inhalation as a remedial process:—1. That the apparatus be simple in its construction, and easily kept in order; 2. That it be capable of keeping up a supply of vapour for any length of time, and that the evolution of the vapour be steady, and easily regulated; 3. That it furnish a sufficient supply of aqueous vapour to prevent any irritation of the larynx or lining membrane of the tubes; 4. And most important of all, that its employment should entail neither trouble nor fatigue on the invalid.

A method of applying solid medicinal substances to the larynx is sometimes used under the term *insufflation.* The substance to be employed is first reduced to an impalpable powder; it is then placed in a tube, one end of which is carried to the back of the mouth, when, by means of a forcible inspiration, a part of its contents is drawn into the larynx. Fluid applications are sometimes introduced into the larynx by means of the *probang;* and sometimes they are inhaled in the form of spray, the fluids being reduced (*pulverised* or *atomised*, as it is called) by instruments invented for the purpose. The latter plan is frequently used for the inhalation of substances that cannot be readily volatilised.

2. *The Genito-urinary tract of Mucous Membrane.*—Medicines are applied to this membrane only for local purposes, and either in the solid or liquid form, as of medicated bougies, caustics, pessaries, and injections. The urethra, bladder, vagina, and uterus are each occasionally treated locally by these means, but in the latter case *only with extreme caution. Injections* are *internal lotions* introduced by means of a syringe into certain canals or cavities of the body, whether natural or the result of disease. They consist of water or other fluid, holding medicinal substances in solution or suspension. The contents of the injection will depend upon the object to be attained; they may be used as astringents or emollients, as irritants or sedatives.

Skin.—Medicines are not absorbed so rapidly by the skin as by mucous membranes. The rate of absorption depends, *cæteris paribus*, upon the delicacy of the tissue. The horny skin of the palms of working-men, for example, would scarcely absorb at all,

whilst between this and the denuded cutis the power of absorption is variously modified. The question of the capability of the skin to absorb medicinal substances from their solution in baths, though fully admitted by the ancients, has been discussed, from time to time, since the close of last century. At that time Abernethy and Falkner concluded, from experiments, that absorption did take place ; and following them, on the affirmative side, were *Braconnot*, *Madden*, *Homolle*, *O. Henri*, *Chevallier* and *Petit*, *Heidler*, and others. Of an opposite opinion were *Seguin*, *Currie*, *Lehmann*, *Kletzinsky*, *Duriau*, *Thomson*, and others. Medicines are applied to the skin either for local or remote purposes ; but in order to produce the latter, they must either be absorbed, or act by counter-irritation. As the cuticle impedes absorption, it is often removed to facilitate the process. The methods of applying medicines to the skin are three .—

1. *The Enepidermic Method.*—By this process, as the term implies, the medicine is simply placed upon the epidermis. Poultices, fomentations, lotions, baths, plasters, blisters, &c., are applied enepidermically.

2. *The Iatraleptic Method.*—This process requires more than mere apposition ; the term signifies *to cure by anointing* (ἰατρεύω and ἀλείφω). It has also been called the *epidermic method*, *anatripsologia*, (ἀνατρίβω, *to rub in*), and *espnoic medicine.* By this method the medicine is rubbed into the skin, as in the application of ointments and liniments. Other substances may be used as vehicles for the active medicinal ingredient, and some writers have recommended the *gastric juice*, *saliva*, and *bile* for this purpose.

3. *The Endermic or Emplastro-endermic Method.*—In this process the epidermis is removed, and the medicine is applied directly to the true skin. Absorption takes place much more rapidly under this than under either of the previous methods. A blistering plaster, or a vesicating ointment or liniment, may be used to raise the cuticle, which may be either removed, or simply opened, to let out the serum and admit the medicine. Small quantities of the more active medicines are usually applied to the cutis thus exposed, such as strychnia, aconitia, tartar emetic, &c.; but extracts, impalpable powders, &c., have also been used, which, however, must be readily soluble, or they cannot be absorbed. The objections to this method are chiefly the pain of the blistering, and, in exposed parts, the disfigurement caused by it ; but it is often of great advantage in cases in which the stomach, from causes already related, cannot be employed, or in the case of a purely local disorder.

Except when the epidermis is raised, and the medicine is directly applied to the *cutis vera*, the operation of medicines introduced by the skin is often tardy and uncertain. The dose of a medicine to be administered by the skin is generally larger than it would be by the stomach; sometimes two or three times more, sometimes six, eight, ten, or even more. There is no rule for regulating the doses thus given; but a safe plan, when we have not had experience of the effects by previous trial, is not to apply more than would be safe if the whole were taken into the system, especially if the medicine be applied *endermically*. Œsterlin suggested the following relative proportions as doses to be applied to the different parts of the body:—By the stomach, 1; by the unbroken skin, 3 to 6; by the endermic application, 1 to 3; by ulcers and suppurating sores, 2 to 4; by enema, 2 to 4. Medicines have also been introduced into the system by *inoculation*, but the practice never became common.

The Hypodermic method.—The injection of medicines into the cellular tissue, by means of a small graduated syringe, with trochar and canula, or with a finely-pointed tubular needle, is practised successfully for the topical application of remedies, as in certain cases of neuralgia. This method is exceedingly prompt, and the effects of the medicines so introduced are often, generally as well as topically, more powerful than when administered by the mouth. It requires, consequently, in the case of a very active medicine such as atropine, that the dose be considerably less than if it were given by the mouth. Care also should be taken to avoid the neighbourhood of a large vein or artery, in the one case, lest harm result from the medicinal substance being suddenly mixed with the circulating fluid, in the other, lest there be troublesome bleeding. In some cases, injurious suppuration of the subcutaneous cellular tissue results even when the substances injected are not of an irritating nature.

Serous Membranes.—Medicines are applied in certain circumstances to serous membranes, but only for local purposes. The most common instance of this is the injection of irritating substances into the *Tunica vaginalis* for the radical cure of hydrocele. With a similar object, strong solutions have been injected into the peritoneal sac for the cure of ascites; but although this practice has in several instances been attended with success, it is fraught with danger.

Wounds.—Whether the result of accident or the gradual effect of disease, as ulcers and abscesses, these lesions have been made the seat of medicinal treatment. Commonly the object of applying medicines to abraded or ulcerated surfaces is to effect their cure;

but sometimes they have been taken advantage of to produce constitutional effects.

Veins.—Medicines act most rapidly when plunged at once into the circulation by means of an open vein. This process has been adopted at intervals for several centuries, now vaunted, now decried. It is unquestionably a dangerous practice, and ought to be resorted to only in last extremities. The dangers are chiefly three: the introduction of air into the vein during the operation proving immediately fatal; poisoning by administering, under the circumstances, too large a dose; and subsequent phlebitis. But this method has in several instances proved successful. It has been serviceable in cases of threatened asphyxia, arising from the impaction of a solid substance in the œsophagus, by which the ordinary method of exhibiting a remedy was prevented. Köhler injected six grains of tartar emetic into a vein of the arm of a soldier; vomiting ensued, by which a piece of beef tendon was ejected from his œsophagus, and the man was thus relieved from threatening asphyxia. In other cases of threatened asphyxia, in narcotic poisoning, in the collapse of cholera, in tetanus, hydrophobia, &c., the injection of water, saline solutions, and other remedies has been resorted to.

Transfusion of Blood.—The transfusion of blood, by connecting the venous circulation of two individuals, has been resorted to with comparative frequency; but, like many other practices attended with danger, it has been from time to time prohibited by general disapproval. After being long in disuse, it was restored by Dr Blundel nearly half-a-century ago. Transfusion has been chiefly used in cases of exhaustion from hemorrhage occurring to women in the puerperal state; it has been resorted to also in hemorrhage from other causes, in anæmia, in epilepsy, in cases in which nutrition is interfered with by organic disease, in debility from profuse discharges, &c.; but it is in hemorrhagic cases that it has proved most successful. The chief dangers attending the operation are the *admission of air into the veins*, and the *coagulation of the blood* in its passage from one vein to the other. Dr Blundel's transfusion syringe is intended to obviate these risks.

Besides the methods already enumerated, by which medicines may be applied to the human frame, there are others also which we cannot dwell upon. There is, for example, a class of *psychical or mental remedial* agencies, which is often of the utmost importance in the treatment of disease. The moral and intellectual affections of the mind demand the physician's attention; when violent they may be subdued, when feeble exercised, and when perverted be

restored to their proper functions. The mind may also be affected by external agencies applied to the senses; thus the eye may contribute attractive scenery, the ear harmonious sounds, the nose and mouth the gratification afforded by pleasant odours and tastes, and the sense of touch the soothing influence of gentle friction. Again, modifications of diet, exercise, sleep, clothing, and all that we comprehend under the term change of climate, form another class of what are known as *hygienic* remedies, which, although they are too extensive to admit of a place in the *Note-Book*, are nevertheless of the highest importance.

5. Circumstances which Modify the Actions of Medicines.—These circumstances may be divided into two classes: A, Those which relate to the medicine. B, Those which relate to the patient.

A. *Circumstances on the part of the Medicine.*—We have already seen that climate, soil, cultivation, and the manner of collecting, preserving, and preparing them, exercise modifying influences upon medicinal substances, especially those obtained from the vegetable and animal kingdoms. Other circumstances also pertaining to the medicines affect their action.

1. *The Dose.*—The action of a medicine differs both in kind and degree according to the quantity administered. In a certain dose a substance may act as a tonic, in a larger as a corrosive irritant; another substance may act as a sedative in a small dose, and as an emetic and indirect stimulant in a larger dose. In small doses medicines usually act slowly, and produce permanent effects when continued for a length of time; in larger doses they act promptly, and are commonly given for temporary purposes.

2. *The Physical Condition of the Medicine.*—The state of *aggregation* of a medicine modifies its effect, both in kind and degree. Medicines act most promptly when minutely divided, as in *solution* and *vapour*. All substances to be absorbed must be either exhibited in a state of solution, or be capable of solution in the secretions of the parts to which they are applied. Many medicines which act promptly and energetically when given in solution, scarcely act at all when given in the solid form; hence the importance of choosing a suitable galenical preparation according to circumstances. The more finely a medicine is divided the less prominent will be its topical, and the more powerful its general, effects. The substances with which medicines are *mechanically* combined also modify their action. They may interpose an impediment to their contact with absorbent membranes, as when arsenic is mixed

with finely divided charcoal, or when medicines become mixed with food after a meal. Under such circumstances substances, which would otherwise have produced powerful effects, are sometimes removed from the alimentary canal, either by regurgitation or by purging, without having caused any serious results. When active principles alone are given, their action often differs from that which follows the administration of the entire substance from which they are obtained; thus quinine, although an elegant form of medicine, is not always an efficient representative of bark, nor morphia of opium.

3. *The Chemical Condition of the Medicine.*—Medicines which act energetically in one form of chemical combination may differ both in kind and degree, as to their action, in other chemical relations. Those which evince a powerful local or topical action are essentially modified by chemical combination, as may be observed in the case of an acid or an alkali; when given separately their action may be powerful, even hazardous, but when combined their effect may be scarcely perceptible. On the other hand, when medicines act by absorption into the circulation, their effects are not modified to the same extent by this circumstance; for there are many medicines—such as morphia, strychnia, arsenic, and others—which produce their characteristic results more or less energetically, in whatever chemical form they may be administered. In reference to this modifying effect with respect to poisons, Dr Christison has laid down *two general laws:*—1. *That poisons which only act locally, have their action much impaired or even neutralised in their chemical combinations.* 2. *That the action of poisons which operate by entering the blood, although it may be somewhat lessened, cannot be destroyed or altered in the chemical combinations.*

B. *Circumstances on the part of the Patient.* *a. Physical causes.* *b. Mental causes.*

a. Physical Causes.—*α. Original Conformation, Symmetrical Peculiarity, Constitution, Idiosyncrasy.*—As no two individuals are alike in these things, so no two are subject alike to the actions of medicines. Many illustrations might be given in support of this dogma, did space allow. Experience alone can determine these peculiarities: we cannot predicate the effect of an untried medicine, except upon very general and vague principles. We cannot foretell, for example, except by experience, as from ancestral or personal history, that a dose of calomel that might be given with advantage to one person will produce salivation in another; that a dose of opium, given to soothe, will result in delirium, or perhaps produce no effect

whatever. The general tendency of *Idiosyncrasy* is to increase the activity of medicines, and even to render injurious things commonly pleasant and innocuous, as in the instance of perfumes, which to some are agreeable, to others overpowering. Many articles of food, shell-fish as an example, which are partaken of freely by some, are poisonous to others. Idiosyncrasy sometimes, however, assumes an opposite character of enabling the individual to take noxious substances with impunity. This is not to be confounded with *Habit*.

β. Habit tends to lessen the action of medicines. Some individuals can take as much opium, arsenic, corrosive sublimate, alcohol, &c., in one day as would poison several unaccustomed persons. The statements respecting arsenic-eaters and corrosive-sublimate-eaters have been accepted with hesitation, but of opium-eaters we have unfortunately only too many examples, and of habitual drunkards still more. With respect to the influence of habit on the actions of poisons, Dr Christison states:—*On the whole, it would appear that more change is effected by habit in the action of the organic than in that of the inorganic poisons; and that of the former, those which act on the brain and nervous system, and produce "narcotism," are altered in the most eminent degree. Bouchardat* has stated that habit will not exempt individuals from the effects of those substances which act as poisons to every member of the organic world; but that exemption may be purchased by habit from the effects of those substances which, although generally poisonous, spare certain classes of organized beings. The *general habits* of the patient, his profession, business, or occupation, his diet, and other circumstances connected with his daily pursuits, influence the actions of medicines; and there are certain indications of treatment in the cases of the rich and the poor, the spare and the plethoric, the man of active and the man of sedentary habits, which are far more easily learned from careful clinical observation than from volumes of literature. The habitual use of cathartics, and especially of that class of enemata, often leads to deplorable results, against which patients cannot be too urgently cautioned.

γ. Age.—Anatomical and physiological circumstances both modify the actions of medicines relative to age, and to a limited extent the influence of age is analogous to that of *stature;* for in children and little adults the medicine has a smaller range of surface to act upon. But this is almost unimportant when compared with the intense susceptibility of children, especially infants, as compared with adults; their nervous system is so readily excitable, that many substances in doses that would scarcely affect an adult, would excite a

child perhaps to convulsions. Aged persons also are more susceptible of the action of certain medicines than adults. Depressing medicines, as evacuants, whether external or internal, are to be used very sparingly at extreme ages; children and old people bear them badly. Children do not bear opiates, but they are not affected constitutionally in the same manner as the adult by comparatively large doses of calomel. No fixed rule can be laid down to determine the doses at certain ages, because the effects of all medicines are not the same at any given age—take opium and calomel as examples. But there is an approximation to a general rule, and it assumes this character, that the dose increases in quantity from birth to the prime of life, reaching its maximum about fifty, and then gradually declines as age advances. The posological tables of Gaubius, Young, and Hufeland are as follow. Gaubius, fixing the doze for an adult as unity, gives the following proportions at different ages:—

Under 1 year,	$\frac{1}{15}$ to $\frac{1}{12}$	Seven years old,	$\frac{1}{3}$
Two years old, . .	$\frac{1}{8}$	Fourteen ,,	$\frac{1}{2}$
Three ,, . .	$\frac{1}{6}$	Twenty ,,	$\frac{2}{3}$
Four ,, . .	$\frac{1}{4}$	Twenty to sixty,	1

Dr Young's rule is, that for children under twelve years the adult doses of most medicines must be diminished in the proportion of the age to the age increased by twelve; or, in other words, add twelve years to the age of the child, and divide the real age by the sum, thus:—

$$\begin{array}{l} \text{Child's age} \\ \text{Add 12} \end{array} \frac{1}{1+12}=\frac{1}{13} \quad \frac{2}{2+12}=\frac{1}{7} \quad \frac{3}{3+12}=\frac{1}{5} \quad \frac{4}{4+12}=\frac{1}{4}$$

Hufeland gives the following proportionate doses for different ages, fixing the adult or maximum dose between the years twenty-five and fifty:—

$\frac{1}{2}$ to	1 month	$\frac{1}{2}$ to 2 parts.	3 to	4 years	16 to 18 parts.
1 ...	2 months	2 ... 4 ...	4 ...	5 ...	18 ... 20 ...
2 ...	3 ...	4 ... 5 ...	5 ...	10 ...	20 ... 25 ...
3 ...	4 ...	5 ... 6 ...	10 ...	20 ...	25 ... 35 ...
5 ...	7 ...	6 ... 7 ...	20 ...	25 ...	35 ... 40 ...
7 ...	9 ...	7 ... 8 ...	25 ...	50 ...	40 ... — ...
9 ...	11 ...	8 ... 9 ...	50 ...	70 ...	40 ... 30 ...
1 ...	2 years	10 ... 13 ...	70 ...	80 ...	30 ... 25 ...
2 ...	3 ...	13 ... 16 ...			

δ. *Sex.*—In childhood there is little difference between the sexes as to the actions of medicines; but in adult life the difference of functional activity excercises a modifying influence. Menstruation, pregnancy, and lactation are circumstances in the female demanding anxious consideration in the administration of medicines. Females are generally more susceptible of medicinal action than males—a rule like the rest, however, which has many exceptions. During lactation, it is to be remembered that medicines given to the mother affect the child.

ε. *Disease.*—The nature and intensity of disease exercises a remarkable influence upon the action of medicines. We have examples of this in the inefficiency of enormous doses of opium in tetanus, and of mercurials in fever. Medicines requiring alkaline secretions to dissolve them will not act when the bile is retained, as in jaundice.

ζ. *Organs and Tissues.*—The action of a medicine is modified, both in kind and degree, according to the nature of the organ or tissue to which it is applied. This modification arises from two causes—the relative absorbent power, and the properties of the secretion of the part. The skin, mucous membranes, serous membranes, wounds, and open veins are the several channels by which medicines may be introduced into the system, and they are here enumerated according to their relative absorbent powers, from the skin, which is least active, to the open vein, which is the direct intrusion of the medicine into the circulation. The modifying influence of *organs* depends, in part, upon the properties of their tissues, but also on their relative sympathetic relations to other organs, and their importance to vitality.

η. *Climate.*—In estimating the value of climate as a modifying cause in the actions of medicines, it is to be remembered that the influence may be exercised upon the drug as well as upon the patient. A plant which yields active medicinal substances in one country, may be medicinally inert, though physically even more luxuriant, when grown in another, an influence which has already been adverted to. We have now to consider the effects of climate upon the patient—the medicine remaining the same. There is much in the *habits* of people of different nations, constituting *national character*, that is to be considered in the word *climate*, for we can scarcely dissociate the elements of daily existence, and allot to temperature, moisture, barometric pressure, and actinic force, such and such portions of the modifying influence. That climate, in this wide sense, does exercise a powerful inflence upon the actions of medicines is scarcely to be doubted; but so complex is the question,

and so intricately interwoven with the multifarious operations of the animal economy, that it is really very difficult to meet with unexceptionable proofs of its action. The following are amongst the instances quoted by Dr Paris and other writers as indications of the effects of climate. The inhabitants of Rome are peculiarly affected by the odour of flowers, in some cases amounting even to syncope. Dr Richard Harrison, in a communication to Dr Paris, stated, as his experience, that narcotics act with greater force, even in smaller doses, at Naples than in England. Extract of Hyoscyamus, given in three-grain doses thrice a-day, produced temporary amaurosis in ten patients ; and this effect was reproduced by a second exhibition of the medicine, although the same patients had been in the habit of taking the medicine in England without any unpleasant result. The same writer states that he had successfully treated several cases of epilepsy in Italy with nitrate of silver, while in England he had not met with the same good results. Mercurials are also more active in Italy than in this country. But mercurials are sometimes given in much larger doses in warmer climates than in our own country : in India, the West Indies, and many other countries, this class of remedies is sometimes administered in what we should consider enormous doses ; not, however, for the purpose of producing constitutional effects, for which, indeed, they are but sparingly used. In his "Diseases of Bengal," Dr Twining states that depletion by blood-letting, purgatives, mercurials, jalap, castor oil, &c., are used more sparingly with the natives than with the resident Europeans. Lascar sailors, it is said, require much smaller doses than Europeans. Persons who have recently changed their residence from one climate to another do not bear the doses usually given at their new residence at once, though the system soon accommodates itself to its altered circumstances. Albers states that Englishmen residing in Bonn are compelled to reduce the doses of medicines which they were accustomed to at home. Dr Lombard, of Geneva, makes the same remark in regard to Englishmen residing in Switzerland. The state of the weather, the season of the year, and the time of day, are also supposed to exercise an influence upon the action of medicines. Dr Annesley states that the subsidiary fever of Nagpore is cured by cinchona bark in the cold season, but that this remedy fails in the rainy season, when it is replaced by calomel and antimony. The prevalence of epidemics is also a modifying cause.

b. Mental Causes.—The intimate relation of the mind and body is such that physical suffering can scarcely be associated with a calm and passionless mind. In every case of sickness one or other of the

mental emotions is aroused, and this the physician has to cherish or subdue according to the necessities of his patient. *Depressing* emotions are seldom favourable to recovery, and when they are predominant, it is our duty to awaken the patient to a feeling of hope, faith, and gladness, in order that the remedies applied may be seconded by that measure of *willingness to recover* without which even the most potent medicines will prove ineffectual. There is, above all, one feeling with which it is absolutely essential that the physician should inspire his patient, that of *faith*, not only in the efficacy of the means employed, but in his own integrity, uprightness, and Christian conduct, an emotion which no personal advantages, however great, should induce him to forego. Diseases complicated with derangement of the intellectual faculties, and with nervous affections such as hysteria, especially demand attention to what may be termed *psychical* therapeutics. Perhaps the most trying cases that a physician has to deal with are those suffering from long-protracted, ultimately hopeless, sometimes very painful diseases, which, whilst they demand his anxious care, afford little or no opportunity of displaying his skill. Perhaps he may feel humiliated, and would rather be without such patients. But no, he has one all-important duty yet to fulfil: his patient is daily craving for some new interference, for something that might surely still be done; but when, after due consultation, it is finally determined that furthur active interference would be unwise, then it is his duty to protect his patient from unprincipled quacks, who endeavour by their disgusting advertisements to attract the attention of such helpless patients or their friends, that they may increase by them their dishonest gains. Then it is that, by a careful balancing of the passions, inspiring no vain hope, whilst he dispels too anxious fears, the Christian physician may soothe the last days of his patient, pointing to that Great Physician in whose presence there is everlasting joy. Then, too, may the patient say:—

> "Let Fear, that watchful guard within,
> Defend my soul from mental sin;
> Let Hope her radiant charms display,
> Dispel all doubts, and speed my way.
> Let Hate her keenest shafts employ,
> Pride, Lust, and Envy to destroy;
> Let no vile thought pollute my frame,
> But love divine my soul inflame.
> Thus every passion kindly given,
> Shall smooth the path that leads to Heaven."

6. The Prescription.—We have already said that the physician's prescription occupies the very centre of the medical sciences, that it

is the practical application of these sciences to the cure of disease. But in this wide sense the word is to be understood as synonymous with the terms *general instruction or direction.* A physician may cure certain patients without the aid of pharmacological remedies, by instructing them in, or directing them to pursue, a certain course of *hygienic* treatment. That, however, is not the sense in which we now use the word: we are to consider it as a *formula* chiefly intended to guide the druggist in the preparation of suitable pharmacological remedies. Prescriptions written by the physician to suit occasions are called *magistral,* because written by a master of his profession, or *extemporaneous,* because written without previous preparation—*ex tempore.*

To prescribe well is no easy matter. Independently of scientific and practical therapeutical knowledge, it demands an acquaintance with the practical details of pharmacy, which, in its turn, involves the laws of natural history, chemistry, and physics. The opportunity of studying practical pharmacy in a private laboratory, in the shop of a pharmaceutical chemist, or at a public hospital or dispensary, should never be neglected by the student of medicine. The knowledge thus acquired will prove to be of the utmost value in after-life; and it must be deeply regretted that so little has been done in this country for the encouragement of *Schools of Pharmacy.*

To write a prescription may appear to be a comparatively trivial matter, and often enough it is not until the student has become the practitioner that he is undeceived. Then he finds that there is a great difference between merely repeating a prescription from memory, and devising and constructing one to suit a special emergency. Prescriptions are written either partly or wholly in *Latin,* or in the *vernacular* language, the latter being used in France, the former more or less in Great Britain. Formerly the three Pharmacopœias of this country were written in Latin, but the later editions of the Edinburgh and Dublin Pharmacopœias, and the British Pharmacopœia, are in English. The *Latin* and *vernacular* languages have both been advocated, and it is still a matter of dispute as to which is the most appropriate. It appears to be generally admitted, however, that the names of the ingredients should be written in Latin, chiefly for the following reasons:—*First,* Because the Latin name of a drug is more definite, usually the same in different countries, and is not rendered unintelligible by moderate contraction; *second,* Because the prescription can then be prepared by dispensers in foreign countries, as well as by those at home;

and *third*, Because it is sometimes necessary to keep the patient in ignorance of what he is taking—a matter of much greater difficulty, however, since the introduction of scientific nomenclature into popular language. The reasons urged against the use of any but the vernacular language are chiefly the fear of mistakes, occurring either in consequence of the doubtful Latin of the prescription, or the ignorance of the dispenser, and that *medical Latin*, being unlike classical Latin, is not always intelligible even to persons of liberal education. The common practice in prescribing, however, is to write in Latin that part of the prescription which is only for the instruction of the dispenser, and to employ the vernacular in the parts common to the dispenser and the patient.

The prescription is generally arranged in the following order:—

1. *The heading of the Prescription* (*the præpositio, or superscription*).—This is used merely to arrest the attention of the dispenser; but it materially affects the grammatical construction of the prescription. It consists simply of the letter ℞. The origin of the practice of thus beginning a prescription is to be found in the ancient and popular belief in the sideral influences, the letter being, in truth, but a modification of the astrological symbol of the planet Jupiter. In early times prescriptions invariably began by a pious or superstitious reference to some controlling power. The expressions J. D. (*juvante Deo*), N. D. (*nomine Dei*), J. J. (*juvante Jesu*), and the characters + and α ω, the sign of the cross, and the *alpha* and *omega* of the Greek alphabet, with reference to the Saviour, were in common use, and were termed the *invocation* or *inscription*. The letter is now, however, understood to be the initial of the word *recipe*, *take*, synonymous with the French superscription *P. prenez.* When this superscription is used, the Latin names of the ingredients following it are put in the *genitive* case, and the quantities of each in the *Accusative*. Thus, ℞ *Liquoris Ammoniæ Acetatis, drachmas duas*, signifies, Take two drachms of the solution of Acetate of Ammonia. When the prescription is written in English, the superscription is "Take of,"—the sign of the genitive case, which is applicable to all the ingredients, being put in the superscription once for all.

2. *The Ingredients that are to be introduced into the Medicine* (*Materiæ designatio, the Inscription*).—The name of each ingredient, usually written in *Latin*, occupies a single line. The ingredients are arranged in one of two ways—either according to their therapeutical value, or according to the order in which the dispenser will find

it most convenient to use them. The latter method is not essential, however, because it is the duty of the dispenser to carry out the intention of the physician by the most appropriate pharmaceutical method; but it is an evidence of superior attainments when the physician can attend both to the therapeutics and the accurate pharmaceutical details of his prescription.

In the selection of the pharmacological remedies to be employed, the physician is guided by the peculiarities of his patient, and the character of the disease to be treated. The circumstances which modify the actions of medicines are to be taken into consideration, in conjunction with the history and present stage of the malady, and the general and special conditions of the patient. Having ascertained these points, the *Materia Medica* is divisible into two parts; the one containing substances that may be used, the other those which obviously cannot be used in the treatment—or, in other words, into medicines that are *indicated*, and those that are *contra-indicated.*

Treatment will vary according to such circumstances as the nature of the disease, the constitution of the patient, and the judgment of the practitioner; but there are a few cardinal rules that never alter, one or two of which I will mention. Never employ powerful medicines when others of a milder kind will answer the purpose: the more of a man's estate that remains after a lawsuit, the greater is the credit due to his legal adviser, and the more constitutional strength the patient has at the close of his illness the more grateful will he be to his physician. Never select a medicine, or administer one in such a manner that, although the disease may disappear during its exhibition, it may be said of its ultimate and permanent effects that they are as bad as or worse than the disease itself. When a plan of treatment has been resolved upon, do not impatiently break through it by frequently changing the medicine, in a vain attempt to combat every symptom; and do not cherish the idea that every improvement in the patient's condition is necessarily due to the medicine, and that every change for the worse is attributable to the disease; this is often a very difficult question to determine, and one which requires the nicest discrimination. Always bear in mind the state in which the patient will probably be in the next, or any subsequent, stage of the disease, and endeavour as much as possible to protect him from treatment that would then militate against him. Always divide the responsibility, by consultation with an experienced brother, before pursuing a course of treatment by

which the life of the patient may be placed in jeopardy. Next to his health, be careful of the patient's pocket; never hesitate to recommend that which is *essential*, however costly, but do not thoughtlessly spend his money upon expensive medicines or mechanical appliances of questionable utility.

The tendency of the practice of the present day is, perhaps, rather towards *simplicity* than *complexity* in prescriptions. We seldom now meet with the curious mixtures that were formerly so common, in which it would seem that the practitioners had united as many ingredients as possible, in the blind hope that one or other of them might hit the mark and cure the disease. But whilst *polypharmacy* is doubtless an evil when uncontrolled by science and reason, we may possibly, by refining too much, fall into an opposite error. Organic chemistry has conferred a great boon upon the physician by discovering and separating many of the powerful constituents of medicinal plants; but experience has shown that these elegant preparations are not always efficient substitutes for the plants themselves. Nor are simple prescriptions always preferable to those which contain two or more ingredients; for, by a judicious combination of medicines, results may be obtained which cannot be derived from individual remedies. What the physician has chiefly to guard against, in the construction of a compound prescription, is the admission of substances the object of whose presence he cannot explain. If there be four ingredients in a prescription, and the prescriber can only explain his intentions with respect to three of them, the fourth should be omitted, as it can only be there on chance. If we were restricted to the use of those drugs alone whose *modus operandi* can be clearly explained, we should at once be cut off from many of the most valuable remedies of the Materia Medica, the use of which rests upon no higher authority than the sanction of experience, and many of the valuable compound officinal formulæ by the same terms would be swept away. But it is not essential to the construction of a compound prescription that the practitioner be able to foretell infallibly the results to be produced by it, nor even that he be able to explain the *modus operandi* of all or any of the ingredients; it is sufficient if he can account for the presence of each constituent of the prescription upon some philosophical principle or plan of treatment. If there be anything present that cannot be thus explained, the prescription would be better without it.

The object of the physician when prescribing should be—in the

words of Asclepiades—*curare cito, tuto et jucunde*, and with this in view, the compound prescription is often—though by no means invariably or essentially—divided into four parts, namely:—1. *The Basis* (the active *curative* principle—*curare*): 2. *The Adjuvant* (*Adjuvans*, an auxiliary, to make the basis act energetically and *quickly—cito*): 3. *The Corrective* (*Corrigens*, to cause the active ingredients to operate *safely—tuto*): and, 4. *The Vehicle or Excipient* (*Vehicula, Excipiens, Constituens*, to give a suitable form, and to render the medicine *pleasant—jucunde*).

The prescriber who can judiciously combine two or more medicines has always more resources at command than one who knows only how to administer single remedies, or is confined to the compound officinal formulæ, or who, in his attempts at extemporaneous combination, fails to produce a useful or suitable medicine. The points to be held in remembrance in prescribing, are chiefly those in relation to the therapeutical action of the remedies, their chemical behaviour both before and after admission into the system, and their physical condition.

Therapeutically, medicines may be rendered more active, either by combining two or more forms of the same substances; by adding to the basis of the prescription an adjuvant not derived from the same substance, but having a similar action, which is intensified by the combination; or by uniting a basis and an adjuvant derived from substances which, when given separately, do not produce a corresponding effect. The therapeutical effects of medicines may be obtained in some cases more fully by the addition of substances by which the untoward effects of the active ingredients are corrected, and without which the latter ingredients would either not be tolerated by the system, or would produce other effects. The ultimate and desired therapeutical effect of a prescription may also be attained by the combination of remedies, which, though capable of producing identical effects when administered separately, attain their object by a different mode of action. And sometimes medicines are united which have separate and distinct indications to fulfil. All these forms of combination may be employed without necessarily inducing any obvious chemical changes.

Chemically, the object of the prescriber is to combine ingredients which either do not alter their original conditions when united in the same compound, or which act upon each other in such a way as to cause the disappearance of the original substances and the formation of a new and suitable compound. When two or more sub-

stances can be united without changing their chemical properties, they are said to be *compatible;* but when their combination gives rise to chemical changes, the substances are said to be *incompatible.* But these terms are to be understood as having merely a chemical significance, and not as precluding such combinations for therapeutical purposes. There are many instances amongst the officinal formulæ of compounds which do not represent the properties of their constituents. It is only when the prescriber unites substances capable of reacting chemically upon each other in such a manner as to cause changes of which he is ignorant, that he runs a risk of producing a compound which may be either dangerous or simply inefficacious as a medicine according to circumstances. When chemical decomposition takes place amongst the ingredients of a prescription, the result may be one of four things:—*First,* That the preparation is dangerous, and unfit for use in the quantities prescribed. *Second,* That it is rendered medicinally inert. *Third,* That a new compound may have arisen with properties similar but more powerful, similar but less powerful, or altogether different from those of the original ingredients ; and *Fourth,* That a new compound may be produced which, though not presenting the desired properties before administration, may be so modified by the secretions of the alimentary canal, as to become a convenient and suitable remedy.

Physically, the object of the prescriber is to produce a medicine suited both to the necessities and feelings of the patient. A medicine which, by its appearance, odour, or taste, is more than usually disagreeable, will probably frustrate the object of the prescriber, by creating an aversion and dread of it in the mind of the patient. The ingredients of a prescription may be *pharmaceutically* as well as *chemically incompatible;* thus, when spirit of nitrous ether and tincture of guaiacum are combined, the result is a gelatinous mass unfit for use. Many of the resinous substances are precipitated from their spirituous solutions on the addition of water, and, therefore, when the ingredients are brought together, a mucilaginous substance is required to form a suitable mixture. This matter has already been adverted to in the section devoted to officinal formulæ.

The quantities of the several ingredients of the prescription are to be represented by certain characters, which have already been described with the weights and measures used in pharmacy. The quantity is placed at the end of each line opposite to the ingredient to which it refers, except in prescriptions where two or more consecutive ingredients are ordered in equal proportions, when the

quantity is written only opposite to the last of them, being preceded by the united letters *āā* (*ἀνὰ*), signifying "of each" *so much.*

When medicines are prescribed in forms in which the doses are divided into separate parts, as pills, powders, draughts, &c., the prescriber may either write the quantities sufficient for one dose, directing the dispenser to send two, four, six, a dozen or more of such; or he may combine the quantities, and direct the dispenser to divide the whole into *so many* pills, powders, &c. Perhaps the former plan is more conducive to careful prescribing, but the latter will, in either case, be adopted by the dispenser.

The *doses* of the ingredients will vary according to circumstances, some of which have already been referred to under the head of *modifying causes.* The prescriber will also consider the following points:—Medicines that are to act promptly, and to fulfil a temporary indication, are usually given in full doses, whilst those which are given to produce constitutional and permanent effects are given in small and generally in gradually increasing doses. Some medicines diminish in activity in proportion to the duration of their exhibition, whilst others increase in activity the longer they are given. In the former case the dose is to be gradually increased, and in the latter gradually diminished. Some medicines are said to *accumulate* in the system; their action is sometimes suddenly manifested in an alarming manner, and does not subside, but, on the contrary, often increases, for some time after the patient has ceased to take them. Medicines with this tendency require extreme caution and watchfulness during their exhibition. Great care is to be observed also in the administration of powerful medicines when the prescription is prepared from a fresh stock of the active ingredient. When a druggist begins a new stock of a powerful remedy, apt to spoil by keeping, he should caution the physician, whose patient has been taking the medicine in increasing doses from the old stock, the probability being that the new will be much stronger than the old. In such cases it is safer to reduce the dose so as to meet the probable difference. The physiological and therapeutical actions of medicines differ according to the doses in which they are given; thus tartar emetic in small doses acts as a diaphoretic and expectorant, but in larger doses as an emetic. But if it be given in gradually increasing doses, it does not produce emesis, but acts in the larger doses as a contra-stimulant. This method of exhibiting such medicines is sometimes spoken of as *establishing a tolerance.* The interval between the doses varies according to the objects to be attained. When medicines are

given for a length of time, with the view of producing gradual and permanent effects, it is important to observe the stated periods of their administration; for it is desirable to maintain a regular chain of effects, which cannot be accomplished if the links are sometimes longer, sometimes shorter, and sometimes omitted altogether. There is one more point of importance, one which is often neglected; it is this, that when a medicine has been administered for a considerable time in gradually increasing doses, it should not, unless unusual circumstances arise, be suddenly stopped, but be gradually diminished in the inverse order of its early administration.

3. *The Directions to the Dispenser* (*Subscriptio, the Subscription*).—These also are generally written in *Latin;* they instruct the dispenser in the manner of preparing the medicine, and as to the form to be given to it. The shortest direction, and a very common one, is the letter M., the initial of the word *Misce*, signifying *Mix* (*the ingredients*). S., the initial of *Solve* (*dissolve* the solid ingredients in the vehicle), is also frequently used. Then commonly follows Ft., the initial and terminal letters of *fiat* or *fiant*, *let be made:* thus—(*Ex His*) *Fiat Haustus* (of these ingredients), *let a draught be made; Fiat Mistura, let a mixture be made; Fiant pilulæ viginti, let twenty pills be made.* Or the instructions may be more minute, as in the following instance:—*Tere oleum cum mucilagine donec probé coiverint, tum sensim adde decoctum, ut fiat enema; Rub the oil with the mucilage until they are well combined, then gradually add the decoction, that an enema may be made.*

4. *Instructions to the patient* (*Signatura, the Signature*).—This part of the prescription is sometimes introduced by the initial letter S., or by the word in full, *Signa* or *Signetur*, *call it*, or *let it be entitled* (the mixture, the draught, &c.) Then follow the directions that are to be written by the dispenser, for the patient's information, upon the label of the bottle or box. Some physicians still write the signature in Latin, but it would be much better if all would write it in English, for such a rule would greatly diminish the risk of errors. The signature should contain full and plain directions as to the quantity to be taken at a time, the intervals between the doses, and the mode in which the medicine may be most agreeably or conveniently administered. All powerful remedies to be applied externally should be distinctly labelled POISON, or FOR EXTERNAL USE ONLY. The new Pharmaceutical Act renders it now imperative upon the dispenser to label all dangerous medicines POISON, whether the physician order it so or not. Patients are seldom provided with

graduated measures wherewith to apportion their doses; they commonly use articles employed for domestic purposes. It is necessary, therefore, that the prescriber should be familiar with the relative capacities of pharmaceutical and domestic measures.

A tea-spoonful	is generally	equal to	1 fluid drachm.
A dessert-spoonful	,,	,,	2 ,, ,,
A table spoonful	,,	,,	4 ,, ,,
A wine-glassful	,,	,,	$1\frac{1}{2}$ to 2 fluid ounces.
A tea-cupful	,,	,,	5 ,, ,, ,,
A breakfast-cupful	,,	,,	8 ,, ,, ,,
A tumblerful	,,	,,	10 to 12 ,, ,,

Sometimes the physician gives verbal directions to the patient himself, and for the signature writes only, "To be taken as directed;" but this is not a good or safe rule to adopt, as serious mistakes may result from it. There are, however, cases in which this form of signature is desirable—namely, those in which full directions for the taking of the medicine would betray the nature of the patient's complaint. Most people are extremely sensitive on this point, and it would be as injudicious for the physician to advertise his patient's malady on the label of the medicine bottle as it would be opposed to medical ethics to repeat what he had seen or heard in a patient's house. The physician cannot be too careful to avoid wounding the feelings of his patient.

5. *Name, Date, and Initials.*—The name of the patient is written legibly, and in English, at the foot of the prescription: beneath it is the date, which is sometimes written in Latin, but with no peculiar advantage. Lastly, the physician's initials complete the prescription. The initials should be distinctly written; indeed it is a question whether it would not be better to write the name in full, so that the dispenser might the more readily recognise the author, and so be able to communicate with him immediately, in case of need. In large cities it must be difficult to recognise the initials of all the physicians; and it is to be remembered that the physician's signature is the only justification for the sale of certain poisonous drugs.

The different parts of the prescription are noted in the following examples:—

1 ℞:	Elaterii, granum dimidium . . .	(*Basis*).
2	Hydrargyri Subchloridi	(*Adjuvans*).
	Pulveris Capsici, ana, grana duo . .	(*Corrigens*).
	Confectionis Rosæ caninæ, quantum sufficiat	(*Excipiens*).

3 Fiat Pilula. Signetur.
4 The pill; to be taken to-morrow morning.
Patient's name.
Date.
Initials.

The following is the *house medicine* or *black draught* of most hospitals:—

1 ℞:	Magnesiæ Sulphatis, unciam . . .	(*Basis*).
2	Tincturæ Sennæ, Tincturæ Jalapæ, ...	(*Adjuvantia*).
	Syrupi Zingiberis, ana fluiddrachmas tres	(*Corrigens*).
	Infusi Sennæ, uncias quinque . .	(*Vehiculum*).
3	Misce. fiat Mistura Aperiens. Signetur.	
4	The Aperient Mixture; to be administered in doses of three or four table-spoonfuls.	

1. Heading, Præpositio, or Superscription. 2. Ingredients, Materiæ designatio, or Inscription. 3. Directions to the dispenser, Subscriptio, Subscription. 4. Instructions to the patient, Signatura, Signature.

The same prescriptions abbreviated:—

℞	℞ Mag. Sulph. ℥i.
Elaterii, gr. ss.	Tinct. Sennæ.
Hydrarg. Subchlorid.	Tinct. Jalapæ.
Pulv. Capsici, āā gr. 2.	Syr. Zingib. āā f ʒiij.
Confec. Rosæ can. q. s.	Inf. Sennæ, f ℥v.
Ft. pil. i. Sig. &c.	M. ft. Mist. Aperiens. Sig. &c.

I have here used the old symbols of the ounce, the fluid ounce, and the fluid drachm, but the student will remember that in the British Pharmacopœia these are replaced by the abbreviations *oz.*, *fl. oz.*, and *fl. dr.*

In writing the prescription, the student will bear in mind the following points:—1. To write distinctly; 2. Not to abbreviate the words so as to make them unintelligible to the dispenser, or in any way to cause errors; 3. To be very particular in writing the characters representing the quantities of the ingredients; 4. Carefully to revise the prescription before parting with it.

PART II.—INORGANIC MATERIA MEDICA.

CLASS I.—METALLOIDS OR NON-METALLIC BODIES.

Group I. Gaseous—Oxygen [Ozone], Hydrogen [Water], Nitrogen, Chlorine.

OXYGEN O = 8 or 16 ; *ὀξύς, acid, γεννάω, I generate.*) Synonyms: Oxygenium,—Aer purus seu dephlogisticatus seu vitalis,—Oxygène,—Sauerstoff—Empyreal Air—Vital Air.

Preparation.—Most commonly by heating together four parts of finely powdered chlorate of potash, and one part of well dried peroxide of manganese ($KClO_3 = KCl + O_3$) ; the peroxide of manganese is used in this process merely because it causes the expulsion of the gas at a much lower temperature than would be required if the chlorate were heated alone.

Characters.—An elementary, permanent, colourless, inodorous, tasteless gas ; the chief supporter of combustion and respiration ; Sp. gr. 1·1057. Its chemical affinity for other elementary substances is very strong, and it enters into combination with all of them except fluorine. It is but slightly soluble in water.

Purity.—Unless carefully prepared, oxygen is apt to contain impurities, the chief of which are chlorine and carbonic acid gases ; solution of nitrate of silver will detect the former, and lime water the latter. The spark of a smouldering match should immediately be converted into flame when immersed in the gas.

Oxygen Water.—Aqua oxygenata seu oxygenii, is simply water charged with oxygen by means of a suitable apparatus, the proportion of oxygen contained in the water being generally as one volume of the gas to two of the water. This preparation is not to be confounded with *peroxide of hydrogen,* which was formerly called *oxygenated* or *oxy-water.*

OZONE.—When first discovered, was supposed to be a new elementary substance, but was subsequently ascertained to be merely a form of oxygen. It is possible to convert ozone into oxygen, or oxygen into ozone, without any other substance being produced. It received its name from its discoverer, Schönbein, who called it ozone, in consequence of its peculiar odour (*ὄζω, I smell*). It is a powerful oxidising agent, is denser than oxygen in the proportion of 3 to 2, is produced when the electric spark is passed through dry air, is contained in electrolytic oxygen, and is formed during the slow oxygenation, of various substances in air, as, for instance, of phosphorus, ether, alcohol, or, more particularly, of certain volatile oils, for example, oil of turpentine.

Oxygen is essential to the support of vigorous animal and vegetable life ; but it cannot be respired in the pure state without

causing injurious effects, and ultimately death. In moderate quantity, sufficiently diluted, it gives rise to exhilaration of spirits, accelerates the circulation, and causes slight diaphoresis, effects which are, however, exceedingly transient.

Formerly, oxygen enjoyed a therapeutical reputation, but it is now seldom administered. The cases in which it has been most frequently used, are those in which pure unvitiated air is obviously indicated, as in asphyxia, whether produced by deprivation of air, or by the inhalation of poisonous vapours ; and in chronic pulmonary diseases in which dyspnœa is associated with general debility. It has also been administered internally in cholera, epilepsy, paralysis, neuralgia, spasms, &c.; and both internally and topically in unhealthy wounds, ulcers, gangrene, &c.

Oxygen water has been given in quantities of one or two bottlefuls daily, as a mild stimulant to the secreting organs. It has been recommended chiefly in cachæmic diseases, with the view of promoting the powers of assimilation and secretion.

The value of *ozone* as a curative and hygienic agent cannot be duly estimated until its properties are more fully recognised; but that it is intimately associated with the health of communities is generally believed. More extended observation of its properties, however, have not realised the expectations that were raised respecting its therapeutical value. It is, probably, in consequence of its oxidising property, a disinfectant. There is abundance of negative evidence of the utility of ozone, such as that it exists in largest quantity in pure air, more abundantly in the higher than in the lower strata of the atmosphere, much more without than within large cities, and more to windward than to leeward of them. It exists more abundantly in some than in other winds, and when air becomes stagnant it vanishes. Cholera and ozone are said to avoid each other. Ozone has been supposed also to be capable of destroying malaria. Schönbein observed that the quantity of ozone in the atmosphere and the prevalence of malarial diseases bore an inverse relation to one another, and this he found to be the case not only in point of time but also in respect of locality, results which have been confirmed by other competent observers.

HYDROGEN (H=1; ὕδωρ, *water*, and γεννάω, *I generate*). Synonyms: Hydrogenium—Hydrogène—Wasserstoff—Inflammable gas.

Preparation.—The readiest method is by the action of zinc upon sulphuric acid in water ($H_2SO_4 + Zn = ZnSO_4 + H_2$).

Characters.—It is a permanent, neutral, invisible, tasteless, and,

when pure, an inodorous gas, but it usually has a peculiar odour due to the presence of foreign substances. It is the lightest form of matter known, its sp. gr. being 0·0693. It burns in contact with air with a pale-yellowish flame, but does not support combustion, and when mixed with air and ignited it explodes violently. It is very sparingly soluble in water.

Purity.—Hydrogen may contain arsenic, sulphur, and other impurities derived from the substances used in its preparation; it must therefore, be tested before it is employed for medicinal or medico-legal purposes. When quite pure it burns with a colourless flame, which leaves no deposit upon the surface of a porcelain dish when depressed upon it, is inodorous, and displays no acid reaction.

HYDROGENII PEROXYDUM (HO_2 or H_2O_2).—Peroxide of Hydrogen was discovered by Thénard in 1818, and is generally prepared according to his process by the action of hydrochloric acid upon peroxide of barium ($BaO_2 + 2HCl = BaCl_2 + H_2O_2$). It was formerly called *oxygenated water* or *oxy-water*, from the supposition that it consisted merely of water holding an additional equivalent of oxygen; but it has been obtained free from water, and is found to be a definite compound of oxygen and hydrogen. It is a colourless liquid of syrupy consistence, having a sp. gr. of 1·452. It is very readily decomposed, and by heat is converted, sometimes with explosion, into H_2O and O. It is soluble in water, is a powerful oxidiser, and bleaches the skin and mucous membrane when applied to them undiluted.

Hydrogen is opposed to oxygen in its action upon the human system; instead of increasing, it diminishes the vital powers, and reduces the circulation. Although not poisonous, it cannot be long inhaled in the pure state, as it does not support respiration, and therefore can only be used when sufficiently diluted with atmospheric air. When thus respired it gives a shrill tone to the voice.

It is not used medicinally in the present day, but was formerly tried in phthisis, rheumatism, paralysis, &c., without attaining a permanent reputation. The respiration of *percarbonated hydrogen gas* was also formerly recommended in affections of the lungs.

Peroxide of Hydrogen, when properly diluted, acts as a stimulant. When applied to the skin or tongue it causes a prickling sensation; it thickens the saliva; and when administered freely has caused profuse salivation. It has of late been strongly recommended in diabetes. It is employed in heart disease, attended with pulmonary congestion, in hooping cough, chronic bronchitis, phthisis, struma, mesenteric disease, rheumatism, jaundice, dyspepsia, &c. Dose fl. dr. ss. to fl. oz. ss., well diluted in water.

AQUA.—Water—Eau—Wasser—Natural Water (HO or H_2O) is placed amongst the Materia Medica of the pharmacopœia. It is required to be the purest that can be obtained, cleared, if necessary, by filtration, and

free from odour, taste, and visible impurity. The chief varieties of fresh-water are rain-water, spring-water, lake-water, river-water, and marsh-water; but as all these varietes contain more or less of impurities, they are unfit for pharmaceutical purposes, for which there is an officinal distilled water. The subject of the purity and properties of common water belongs rather to hygiene than to pharmacology.

Aqua Destillata—Distilled Water.

PREPARATION.—*Take of water, free from taste and odour, ten gallons. Distil from a copper still, connected with a block-tin worm,*[1] *reject the first half gallon,*[2] *and preserve the next eight gallons.*[3]

[1] In order to preserve the water from contamination, the apparatus should not be used for any other purpose. [2] The first half-gallon might contain volatile impurities. [3] Empyreumatic matters, arising from the charring of organic substances, might be carried over if the process were continued beyond the distillation of eight and-a-half gallons.

PURITY TESTS.—*A fluid ounce of it evaporated in a clean glass capsule leaves scarcely a visible residue.*[1] *It is not affected by sulphuretted hydrogen,*[2] *oxalate of ammonia,*[3] *nitrate of silver,*[4] *choride of barium,*[5] *or solution of lime.*[6]

[1] Showing the absence generally of fixed impurity. [2] Absence of lead, copper, and other metallic impurities. [3] Absence of salts of lime. [4] Absence of chlorides. [5] Absence of sulphates. [6] Absence of carbonic acid.

Natural, plain, or common water is largely used as an article of diet, both alone and as a constituent of solid food and of beverages. Medicinally it serves, when taken internally, as a diluent, solvent, and occasionally as an evacuant; externally it acts, according to the temperature at which it is applied, as a detergent, a tonic, a sedative, an emollient, a counter-irritant, &c.; and in the form of *water-dressing* it is of great value as an application to inflamed surfaces, wounds, and ulcers. It generally constitutes the *liquor* of cataplasms, and is the menstruum of many officinal formulæ. Water is also largely used for baths, which may be either simple or medicated, local or general. When water alone is used, the effects of the bath will be determined by its temperature and duration. Baths are cold when the temperature of the water is below 60°; cool from 60° to 75°; temperate from 75° to 85°; tepid from 85° to 92°; warm from 92° to 98°; and hot from 98° to 112°. The temperature of the vapour-bath ranges from 112° to 144° Fahrenheit. Distilled water is largely used in most of the pharmaceutical processes requiring water as a menstruum, especially in the preparation of infusions, decoctions, and medicated waters.

AQUÆ MINERALES.—Every variety of natural water contains more or less of foreign substances in solution or suspension, to which it

owes its peculiar taste, odour, or appearance, so that every spring that yields a good potable water might with propriety be called a mineral spring. The term *Mineral Water,* however, is usually confined to such as yield a larger than the ordinary quantity of earthy, saline, or organic ingredients, which are sometimes of high temperature, and are generally known to medical men by their effects upon certain forms of disease.

The sea affords the most complete example of a mineral water, for it holds in suspension every variety of tellural ingredient, carried into it by innumerable rivers, as well as certain principles peculiar to itself which land-springs do not usually possess.

Mineral waters derive their ingredients from the rocks and soil through which they pass in their way to the surface of the earth. They contain, besides a variety of saline principles, a certain quantity of organic and inorganic substances, together with more or less of a free gas, either sulphuretted hydrogen, carbonic acid, nitrogen, or oxygen. They usually contain in greater or less quantity some or all of the following salts :— The hydrochlorates, sulphates, and carbonates of soda, lime, magnesia, potash, alumina, baryta, strontia, lithia and manganese. Besides these there are occasionally found bromine and iodine, and a variety of metallic salts, such as those of iron, copper, arsenic, &c. Some springs contain what has been imperfectly described as a *vegeto-animal* substance, known by the names of *baregine, glairine,* or *zoogine,* and another substance called *sulfuraire.* The former of these is amorphous, of gelatinous consistence, and of varying colour, density, and quantity; its constitution and use are but imperfectly understood, but it is supposed to give rise to the *chicken-broth* odour peculiar to certain springs. The latter is an organic substance, and belongs probably to a species of confervæ.

The two varieties into which mineral waters are generally primarily divided are *hot* or *thermal* and *cold;* and secondarily they are subdivided in a variety of ways, according to their predominating ingredients. We shall here consider them briefly under six principal classes, namely:— 1. Gaseous, acidulous, or carbonated ; 2. Sulphurous or hepatic; 3. Alkaline ; 4. Chalybeate ; 5. Bromo-ioduretted ; and 6. Saline.

1. *Gaseous, Acidulous, or Carbonated Waters* are those which, in addition to their mineralizing ingredients, are more or less charged with carbonic acid gas. They are generally limpid, colourless, and sparkling, and have a sharp sourish taste, and a feeble and evanescent acid reaction. These waters seldom owe their therapeutic value to their gaseous constituent alone, for it is usually associated with a variety of saline ingredients, some of which are held in solution by the gas, and are deposited when it escapes. After the escape of the gas, these waters have a flat, insipid taste ; but when taken whilst strongly charged with it, they are refreshing and exhilarating, even almost to inebriety.

The kind of cases to which this class of springs is applicable depends upon their further constitution. The effect of the gaseous principle is to allay irritability of the digestive system, to increase and modify the secretion of the kidneys, and to excite the nervous system. Besides this, it imparts an increased activity to the other ingredients, rendering them more powerful in their effects upon the system. Such springs should be administered cautiously at first, for they sometimes produce unpleasant symptoms, of which fulness in the head is the chief. They should never be administered during active febrile or inflammatory conditions, nor

where there is a tendency to apoplexy. They are largely used in cases of chronic irritable dyspepsia, and also to allay spasmodic action of the stomach and bowels, to arrest vomiting arising from functional causes, to quench the thirst attending chronic affections of the digestive organs, and generally to increase the powers of digestion, and to give an impulse to functional activity in all disorders consequent upon an atonic state of the abdominal viscera. Gaseous or acidulous waters are more commonly cold than hot, and common spring water, charged with carbonic acid gas, with or without the addition of artificial salts, is not unfrequently substituted for them. Artificial selters or seltzer water is frequently used. We have examples of the thermal variety of this class of mineral waters in the springs of Ems, Wiesbaden, Schlangenbad, Gurgitello (in the Island of Ischia), St Nectaire, Bath, Bristol, Buxton, &c.; and of the cold variety in the springs of Selters, Enghien, Marienbad, Geilnau, Spa, Pyrmont, Pougues, Chateldon, Condillac, Tunbridge, Cheltenham, Pitcaithly, &c.

2. *Sulphurous or Hepatic Waters* are characterised by the presence of hydrosulphuric acid, either in a free state or in combination in the form of a hydrosulphate. They are readily recognised by their disagreeable, fetid, rotten egg-like odour, and their frequently bitter and saline, and always disagreeable taste. It is to the class of sulphuretted waters that the substances known as *glairine*, *baregine*, or *zoogine*, and *sulphuraire* belong. Sulphurous springs generally belong to the thermal class, and many of them have a very high temperature, but a few are cold. They usually contain also hydrochlorates, sulphates, and carbonates of soda, magnesia, and lime, and in some instances free carbonic acid gas.

This class of mineral waters is more frequently used than any of the others, and is perhaps the most powerful variety that can be recommended as simple alteratives. The sulphurous waters act as excitants, quicken the circulation, and increase the functional activity of the skin and kidneys, producing free diaphoresis and a copious discharge of urine. At the same time they improve the appetite, and, according to the proportions of their ingredients, act as deobstruents and laxatives. Their use should be commenced with extreme caution, gradually increasing the dose, if taken internally, or the duration of the bath when applied externally. If headache supervene, accompanied by a rapid pulse, with a feverish and sleepless state of the system, their use should be diminished, if not entirely suspended for a time. Their exhibition is indicated only in chronic states of disease. They are considered valuable remedial agents in chronic rheumatism; in chronic cutaneous diseases, especially in eczema, impetigo, psoriasis, lepra, prurigo, &c.; in many forms of functional affections of the uterus; in scrofula, in diseases of the joints, and in old cicatrices, especially those of gun-shot wounds; in advanced stages of syphilis; in the ilimination of cumulative medicines, such as mercury; in some forms of chronic bronchial and pulmonary affections, &c. We have examples of sulphurous waters in the thermal springs of Aix-la-Chapelle, Aix (Savoie), Baden (Austria), Schinznach, Barèges, Eaux-Bonnes, St Sauveur, Cauterets, Bagnères-de-Luchon, Bagnères-de-Bigorre, &c.; and in the cold springs of Enghien, Weilbach, Harrowgate, Moffat, Strathpeffer, &c.

3. *Alkaline Waters* are characterised chiefly by the presence of carbonote and bicarbonate of soda in considerable quantity, and in a less

degree by the presence of the carbonates of lime and magnesia. They contain also a variety of mineralising ingredients besides these; but it is to the carbonates of soda especially that they owe their medicinal reputation. They are usually more or less charged with free carbonic acid gas, so as to belong in part to the class termed *gaseous* or *acidulous.* These waters allay irritability of the mucous membrane lining the digestive apparatus, due to the presence of an uncombined acid; they are sedative in their effects upon the nervous system generally; and act also, like other varieties of mineral water, by increasing the functional activity of the skin and kidneys. They are recommended in certain kinds of dyspepsia complicated with acidity; in chronic bronchial and pulmonary affections; in chronic cutaneous affections; in certain calculous disorders; in diabetes and Bright's disease of the kidney; in gout; in glandular enlargements; in organic and functional diseases of the uterus, &c. Their exhibition requires extreme caution, not only in the selection of a suitable spring, but also in the mode of administering the waters. The *Grand Grille* at Vichy is the principal spring of this kind, and we have other examples in the thermal springs of Ems, Mont Dore, Ischia, &c., and in the cold springs of Bilin, Vals, Ilkestone, Malvern, &c.

4. *Chalybeate, Ferruginous, Martial, or Tonic Waters* are characterised by the presence of iron, usually in the form of carbonate, but sometimes as a sulphate. The carbonate of iron is held in solution by an excess of carbonic acid gas, which, on the escape of the water from the ground, is readily liberated, leaving the oxide of iron as a red deposit, so common in the vicinity of these springs. Recent analysis has discovered in this deposit the presence of a small quantity of arsenious acid, which, no doubt, contributes largely to the active properties of the waters. These waters are recommended in all cases showing a want of red blood; in scrofula and other vitiated conditions of the system; in functional disorders of the uterine system; in chlorosis; in hysteria, epilepsy, chorea; in spermatorrhœa; in local nervous pains, and in many other affections in which the use of iron is indicated. The bowels should be carefully regulated during their administration, and their use should be suspended upon the appearance of head symptoms. This variety has so many representatives that it is almost impossible to make a small selection. The springs of Mont Dore, St Nectaire, Vichy, Töplitz, and Bath may pass for examples of the thermal class, and Pyrmont, Spa, Tunbridge, Hartfell, &c., for the cold variety.

5. *Bromo-ioduretted Springs* contain iodide of sodium and bromide of magnesium, associated with more or less of chloride of sodium, and other saline ingredients. Sea-water contains these principles, and is probably more useful, considering the conjoined advantages of sea-air and sea-bathing, than any of the springs recommended for the sake of their iodine and bromine. These waters are employed in strumous affections, in which they exercise a beneficial effect, especially apparent where there is marked glandular or cutaneous manifestation of the disorder. They are used also in cases of goitre, in uterine affections, in visceral congestions, and occasionally in rheumatism and gout. The action of these waters depends greatly upon the nature and quantity of the saline ingredients with which the iodides and bromides are associated. We have examples of this variety in the springs of Kreuznach, Kissingen,

Homburg, Hall, Aix (Savoie), Castel Nuovo, Durckheim, Krankenheil, Woodhall, &c.

6. *Saline Waters* contain a variety of salts; in short, all mineral waters are saline, but for the sake of easier description they are usually divided, according to the acids which enter into their constitution, into carbonated, muriated or hydrochlorated, and sulphated waters. Waters containing free carbonic acid gas have been considered under the head of gaseous, acidulous, or carbonated waters, and those containing the carbonates of soda in excess have been mentioned as alkaline waters. The *Muriated Saline Springs* are characterised by the presence of chlorides or muriates in preponderating quantity, although they may be associated with other ingredients, to which chiefly their medicinal reputation is attributable. Their principal ingredients are the muriates of soda, lime, and magnesia, to which may be added in smaller quantities the carbonates and sulphates of soda, lime, magnesia, and iron, together with bromides and iodides, as well as a certain amount of free carbonic acid or sulphuretted hydrogen gas.

Their action is alterative, slightly purgative and tonic, and they are employed in a variety of diseases according to their natural combination with specific remedies, such as iron, sulphur, iodine, bromine, &c. Waters that contain chloride of sodium in great excess are called *brines or salt waters;* they are seldom used internally, and only when well diluted; but in the form of baths they are extensively employed. Waters, whose chief ingredients are the sulphate and carbonate of lime, are called *calcareous or earthy waters.* The *sulphated salines* are characterised by the presence of sulphates in excess. They usually contain either the sulphates of soda (Glauber salts), of magnesia (Epsom salts), or of lime, frequently associated with the sulphate of potash, the muriates of soda and magnesia, and the carbonates of soda, lime, magnesia, or iron, together with more or less of free carbonic acid gas. In the case of the Sandrock Spring, in the Isle of Wight, the sulphate of iron is in excess. Their action is aperient and alterative, and they are generally heavy of digestion, unless mixed with carbonic acid gas. They are employed in cases requiring interference in the action of the secreting and excreting organs, to which they impart a decided stimulus, and through them relieve the system of many disorders. Those waters, which contain the sulphates of soda and magnesia in excess, are called *bitter* or *purging* waters. Of saline springs the following are examples:—

1. *Simple Muriated Waters.*—Wiesbaden, Baden-Baden, Balaruc, Bourbonne-les-Bain, Niederbronn, Luxeuil, Kissingen, Homburg, Pyrmont, Cheltenham, Leamington, &c. 2. *Brines or Salt Waters,* sea water—Rehme, Nauheim, Kreuznach, Salzhausen, Ashby-de-la-Zouch, Middlewich, Nantwich, Droitwich, &c. 3. *Calcareous or Earthy Waters*—Wildungen, Leuk, Lucca, Weissenburg, Lippspringe, Pisa, Bath, Buxton, Bristol, &c. 4. *Bitter or Purging Waters*—Saidschütz, Sedlitz, Pullna, Kissingen, Friedrickshall, Epsom, Leamington, Cheltenham, &c.

Mud Baths are formed of the soft earthy substances brought by certain mineral waters to the surface of the earth, and there deposited. They are applied either locally or generally, and in many diseases are considered to be more active than the waters themselves. They are used at many of the bathing establishments, such as Dax, Barbotan, St Amand, Acqui, &c., in a variety of diseases, of which chronic rheumatism, cuta-

neous affections, indolent ulcers, pseudo-anchylosis, injuries and diseases of the joints, bones, &c., are examples.

Sea-Water and Sea-Bathing.—Sea-water is richly charged with a diversity of saline ingredients. It is sometimes taken internally, when its effects vary according to the quantity imbibed. In doses of half a tumbler occasionally repeated, it is alternative and tonic ; in larger doses it is purgative, and as such is frequently employed as a deobstruent in congestion of the abdominal viscera. *Sea-bathing* is employed both in preventive and curative medicine. In the former it cleanses the skin, and renews its elasticity and contractility, thereby imparting additional vigour and activity to the frame, and lessening the tendency to take cold during exposure to vicissitudes of temperature. In the latter it operates much in the same way, adding firmness and tone to the textures, and so increasing the functional activity of the vascular, nervous, and secretory systems. In all cases showing impaired functional powers, without any manifestation of inflammatory symptoms—in short, in those cases in which the exhibition of alteratives and tonics is indicated—sea-bathing may, with proper precautions, be resorted to. It is contra-indicated in persons of plethoric habit of body, in cerebral congestion, in organic disease of the heart, in aneurism, and, indeed, in such cases as have not the ability to encounter the severe shock ; and, moreover, at certain periods in which the female constitution is not prepared for the application of powerful remedies.

Factitious Mineral Waters were formerly much employed in cases in which the patients could not be conveniently removed to the springs, and many formulæ have been constructed for the imitation of the more popular waters ; but the means of transport between different countries are now so greatly increased, that the mineral waters of any district can be readily and cheaply imported. It is, however, certain that mineral waters act most beneficially when taken at the springs, probably because of the adjuvant circumstances of change of climate, scenery, habits, &c.

NITROGEN (N = 14.) *Synonyms:* Nitrogenium—Azote (α priv. and ζωή, *life*)—Nitrogène—Stickstoff—Gaz Azoticum.

Preparation.—Nitrogen may be readily obtained by burning phosphorus in confined air, or by otherwise depriving atmospheric air of its oxygen.

Characters.—It is a permanent, colourless, tasteless, inodorous gas, having a specific gravity of 0·967. It does not support combustion ; and, although it is an essential constituent of atmospheric air, it cannot be respired in a pure state without destroying life, a result due probably rather to the absence of oxygen than to any poisonous effects of the nitrogen itself.

When respired in the pure state it causes death, probably by asphyxia in consequence of the exclusion of oxygen. Like hydrogen it is opposed in its action to the stimulating effects of oxygen.

It has been recommended, mixed with common air, as a sedative in certain pulmonary affections, but it is not used alone as a therapeutic agent. As a constituent of the *flesh-forming* principles it is an essential article of diet.

Protoxide of Nitrogen ($NO = 22$, or $N_2O = 44$).—Nitrogenii protoxydum, laughing gas—produces remarkable effects when respired by man. It generally gives rise to a kind of temporary delirium, accompanied by an exuberance of muscular activity, which takes the form of dancing, fighting, singing, &c., according to the natural proclivity of the individual. This condition generally soon passes off, but in some instances serious results have followed the exhibition of the gas. It has been used therapeutically in spasmodic asthma, paralysis, and other diseases, but is now rarely employed. It is possessed of anæsthetic properties, and attempts have lately been made to introduce it as a substitute for chloroform in dentistry operations. It induces unconsciousness rapidly, the effects pass off very quickly; but the condition it produces borders very closely upon asphyxia, and on the whole the results have not been such as to warrant general approval. Water charged with the protoxide of nitrogen has been given as a stimulant and excitant in enfeebled conditions of the system, and is contra-indicated in inflammatory cases.

CHLORINE ($Cl = 35·5$; χλωρός, *green*). *Synonyms:* Chlorum—Chlorinium—Spiritus Salis marini dephlogisticatus—Chlore—Chlor.

Preparation.—Chlorine may be obtained by the following, besides other methods. 1. By the action of sulphuric acid upon a mixture of chloride of sodium and black oxide of manganese ($2NaCl + MnO_2 + 2H_2SO_4 = Na_2SO_4 + MnSO_4 + 2Cl$). 2. By the action of peroxide of manganese upon hydrochloric acid with the aid of a gentle heat ($4HCl + MnO_2 = 2H_2O + MnCl_2 + 2Cl$).

Characters.—Chlorine gas has a yellowish green colour, a pungent suffocating odour, so that it cannot be respired unless it be sufficiently diluted, and a somewhat astringent taste. It can be reduced to a liquid under a pressure of four atmospheres at a very low temperature. Its specific gravity is 2·47; it is soluble in water, and, in the presence of moisture, destroys vegetable colours. When quite dry chlorine does not bleach, and this property is by some supposed to be due to the evolution of nascent oxygen, produced by the decomposition of aqueous vapour ($2\ Cl + H_2O = 2HCl + O$). With nitrate of silver it gives a curdy white precipitate, which is insoluble in dilute nitric acid, but soluble in ammonia.

Antidotes.—Careful inhalation of ammoniacal gas, or the vapour of warm water. The inhalation of sulphuretted hydrogen has also been recommended; but, being itself a dangerous poison, its use must be very cautiously tried. A weak acid solution of aniline in water has been recommended to be applied to the nostrils on a handkerchief, the aniline being converted by the chlorine into aniline *mauve*.

Chlorine for deodorizing purposes may be readily disengaged by the gradual addition of dilute sulphuric acid to chlorinated lime; or by the

action of dilute sulphuric acid upon binoxide of manganese and common salt. The proportions of these ingredients, as recommended by Professor Faraday, are one part of well bruised common salt with one part of binoxide of manganese, which are to be placed together in a flat, shallow earthen vessel; two parts of sulphuric acid with one part by weight of water are to be mixed in a wooden bowl, and when the heat caused by their combination has subsided, this mixture is to be poured upon and stirred with the other ingredients. The vessel, from which chlorine will continue to be evolved for several days, should be placed in an elevated position, so that the gas, which is heavier, may gradually permeate the atmosphere. A process for providing chlorine of proper strength for inhalation is the following:—

VAPOR CHLORI.—Inhalation of chlorine.

PREPARATION.—*Take of chlorinated lime,* 2 *ounces ; water* (*cold*), *a sufficiency. Put the powder into a suitable apparatus, moisten it with the water, and let the vapour that arises be inhaled.*

Chlorine, when pure, is a powerful local irritant, irrespirable, and causing redness, pain, inflammation, and ultimately desquamation when kept in contact with a circumscribed portion of skin. Workmen who are constantly exposed to it can respire the gas when of considerable strength, but they become gradually emaciated, and suffer from acidity of the stomach. In medicinal doses it is stimulant, tonic, alterative, antiseptic, and disinfectant. It simultaneously invigorates and tranquillises the nervous system ; acts upon the liver and salivary glands, modifying in quality and quantity their respective secretions ; improves the appetite, increases the digestive powers, and, at the same time, acts as an astringent on the bowels, causing constipation.

It has been recommended—*in chronic affections of the liver*, sufficiently diluted, as a vapour bath, at 150°. *In phthisis pulmonalis, chronic bronchitis, chronic catarrh, hooping cough*, &c., by inhalation, sufficiently diluted. *In typhus, typhoid, and scarlet fevers, in erysipelas, and in syphilitic affections*, as a stimulant, tonic, alterative, and antiputrescent. *As an antidote*, in cases of poisoning by hydrocyanic acid, sulphurretted hydrogen, and sulphide of ammonium, cautiously inhaled. *In rabies canina*, and in cases of poisoning by the bites of other animals, as a topical application, though there is good reason to doubt its efficacy in rabies. *In offensive wounds, ulcers, and sores*, as a deodoriser, disinfectant, and antiseptic. *As a general deodoriser and disinfectant*, to purify the atmosphere of hospitals, &c.

Liquor Chlori.—*Synonyms:* Liquor Chlorinii—Aqua Chlorinei—Chlorum Aquosum—Chlorine water—Chlorine gas dissolved in half its volume of water, and constituting 0·006 of the weight of the solution.

PREPARATION.—*Take of hydrochloric acid, 6 fluid ounces; black oxide of manganese, in fine powder, 1 ounce; distilled water, 34 fluid ounces. Put the oxide of manganese into a gas-bottle, and having poured upon it the hydrochloric acid diluted with two ounces of the water, apply a gentle heat, and, by suitable tubes, cause the gas, as it is developed, to pass through two ounces of the water placed in an intermediate small vial, and thence to the bottom of a three-pint bottle containing the remainder of the water, the mouth of which is loosely plugged with tow. As soon as the chlorine ceases to be developed, let the bottle be disconnected from the apparatus in which the gas has been generated, corked loosely, and shaken until the chlorine is absorbed. Lastly, introduce the solution into a green glass bottle furnished with a well-fitting stopper, and keep it in a cool and dark place.*

Rationale ($4HCl + MnO_2 = 2H_2O + MnCl_2 + 2Cl$). The object of the *intermediate small phial* is merely to wash the gas as it passes over, and to prevent the passage of minute quantities of manganese and hydrochloric acid which might otherwise contaminate it. The object of the last clause of the instructions is to preserve the solution from the effects of the atmosphere and of light, by which it is readily decomposed at first into hydrochloric and hypochlorous acids ($2H_2O + Cl_4 = 2HCl + H_2Cl_2O_2$), and ultimately into HCl and O, a change which in spite of all precaution takes place when the solution is long kept.

CHARACTERS.—*A yellowish-green liquid, smelling strongly of chlorine, and immediately discharging the colour of a dilute solution of sulphate of indigo.*

The liquid is clear, has the choking property of chlorine, and a feebly styptic taste. It dissolves gold leaf, and discharges the colour from litmus and other vegetable substances.

PURITY TESTS.—*Specific gravity,* 1·003. *Evaporated, it leaves no residue. When twenty grains of iodide of potassium, dissolved in an ounce of distilled water, are added to 439 grains by weight (1 fluid ounce) of this preparation, the mixed solution acquires a deep red colour, which requires for its discharge 750 grain measures of the volumetric solution of hyposulphite of soda, corresponding to 2·66 grains of chlorine.*

Liquor Chlori readily decomposes, and is then unfit for medicinal purposes: it may also contain fixed impurities, which would be detected by leaving a residue on evaporation. But it is chiefly important to know that the proper relative quantities of chlorine gas and water are present, to ascertain which is the object of the third of these tests. The iodide of potassium is decomposed by the chlorine, the result being chloride of potassium and free iodine, which gives the reddish colour. The iodine reacts upon the hyposulphite of soda, converting it into colourless *Iodide of Sodium and Tetrathionate of Soda*—($2Na_2S_2H_2O_4 + I_2 = 2NaI + Na_2S_4O_6, 2H_2O$).

Dose.—For internal administration the dose may be from min. x or xx to fl. dr. ½ or fl. drs. ij, iij, or iv, diluted in eight times the respective quantities of water sweetened with syrup. As a lotion or gargle, the strength may be about 1 of the solution to 8 of water, varying the proportion according to circumstances.

Antidotes.—Albumen, as white of egg, milk, flour, magnesia, chalk, soap, diluents, subsequently combat inflammatory consequences.

Liquor Chlori, when administered of full officinal strength, acts as a powerful irritant, causing inflammation of the skin when applied externally, and acting as an irritant poison when taken internally. When sufficiently diluted, it operates as a stimulant, tonic, and alterative, besides exercising to a certain extent the disinfectant and antiseptic properties of the undiluted gas. It has been said to cause salivation after long administration. It has been recommended internally in the lowest forms of fever having a malignant tendency, or in which the fluids are believed to possess a special tendency to putrescency, such as typhus, typhoid, smallpox, and scarlatina; also in certain chronic diarrhœas, in epidemic dysentery, in erysipelas, and as an alterative in chronic diseases of the liver and in syphilitic affections. It has also been used as an application in cutaneous affections, including certain forms of herpes and psoriasis, tinea, porrigo, scabies, &c., and it has been applied at the period of eruption in variola. It is useful as a stimulating and antiseptic application to cancerous and sloughing ulcers. As a gargle, it is serviceable in malignant sore throat and aphthous and other ulcerations of the mouth and fauces. As a rubefacient, it is applicable in chronic affections of the liver. As an antidote, it has been recommended in cases of poisoning by hydrocyanic acid, sulphuretted hydrogen, sulphide of ammonium, &c. A little of the solution added to the water in which the hands are washed after visiting infectious cases is a wise precaution.

Calx Chlorata.—*Synonyms:* Calx Chlorinata—Chlorinated Lime—Hypochlorite of Lime—Bleaching Powder—Chlorure de Chaux—Hypochlorite de Chaux—Chlor Kalk—a product obtained by exposing slaked lime to the action of chlorine gas as long as the latter is absorbed. It possesses bleaching and disinfecting properties.

Characters.—*A dull white powder, with a feeble odour of chlorine, partially soluble in water. The solution evolves chlorine copiously upon the addition of oxalic acid, and deposits at the same time oxalate of lime.*

The exact constitution of this substance has not been determined, and it is probably not always the same. It is, however, generally believed to consist of one equivalent of Hypochlorite of Lime ($CaCl_2O_2$), and one equivalent of Chloride of Calcium ($CaCl_2$), with a variable amount of Hydrate of Lime. It has an acrid bitter taste. When quite pure ($CaCl_2O_2 + CaCl_2$) chlorinated lime is entirely soluble in water, but it generally, though not essentially, contains a certain amount of hydrate of lime, which is insoluble. When exposed to the air it absorbs carbonic acid, which liberates the chlorine and converts the substance into a deliquescent compound of carbonate of lime and chloride of calcium. Consequent upon the presence of chlorine, this preparation possesses bleaching and

the so-called disinfecting properties, which are developed more energetically on the addition of an acid.

PURITY TEST.—*Ten grains mixed with thirty grains of iodide of potassium, and dissolved in four fluid ounces of water, produce, when acidulated with two fluid drachms of hydrochloric acid, a reddish solution, which requires for the discharge of its colour at least* 850 *grain measures of the volumetric solution of hyposulphite of soda, corresponding to* 30 *per cent. of chlorine, liberated by hydrochloric acid.*

The explanation of this test is as follows:—The hydrochloric acid liberates the chlorine, which, seizing upon the potassium of the iodide, sets iodine free. The iodine imparts the reddish colour to the solution, which will be discharged by the prescribed quantity of hyposulphite, if the chlorine be present in proper quantity (namely, 3·017 grains): the hyposulphite and the iodine uniting to form the colourless iodide of sodium and tetrathionate of soda, as explained under Liquor Chlori.

LIQUOR CALCIS CHLORATÆ.—SOLUTION OF CHLORINATED LIME.—*Take of Chlorinated Lime,* 1 *pound; Distilled Water,* 1 *gallon. Mix well the water and the chlorinated lime by trituration in a large mortar, and, having transferred the mixture to a stoppered bottle, let it be well shaken several times for the space of three hours. Pour out now the contents of the bottle on a calico filter, and let the solution which passes through be preserved in a stoppered bottle.*

TESTS.—*Specific gravity* 1·035. *Sixty grains by weight mixed with twenty grains of iodide of potassium dissolved in four fluid ounces of water, when acidulated with two fluid drachms of hydrochloric acid, gives a red solution which requires for the discharge of its colour* 500 *grain measures of the volumetric solution of hyposulphite of soda, corresponding to* 13 *grains of available chlorine in a fluid ounce.*

The explanation of this test has already been given above.

Dose.—Internally, gr. ij to v dissolved in a suitable vehicle and strained. Externally, solutions of various strengths are used, according to circumstances, in the proportions of from gr. x to dr. i to an ounce of water, carefully strained. For deodorizing purposes a weak acid is added to a little of the powder placed in a shallow earthen vessel. Dose of the officinal solution, min. xx to xl in a wine-glassful of water; externally as a lotion to ulcers, and for the cure of scabies, one part to three of water; as a gargle, one to seven of water; also of various strengths, according to the nature of the application, bearing in mind that one fluid ounce contains nearly forty-four grains of chlorinated lime.

Antidotes.—Albumen, as white of egg, milk, flour, and water, magnesia, chalk.

CALX CHLORATA acts upon the system perhaps in the threefold manner of chlorine, chloride of calcium, and lime. It is not so much used internally as the solution of chlorinated soda. It acts as an irritant, astringent, antiseptic, and disinfectant. Internally, it acts as an irritant of the mucous membrane, giving rise, in large doses, to great pain in the epigastric region, accompanied by vomiting

and purging. In medicinal doses it operates as a stimulant and astringent, for which purposes it has been recommended in low febrile states, in certain forms of chronic diarrhœa, and in epidemic dysentery, and as a local stimulant and purifying agent in unhealthy and fetid sores. In solutions of various strengths it may be applied as a gargle in malignant sore throat, and as a wash in ulcers of the mouth, tongue, gums, and lips, and also in mercurial ptyalism ; as an injection in fetid discharges from the nose and ears; and, well diluted, as a topical application in purulent ophthalmia; as a lotion in cancerous and other ulcers producing fetid discharges; as an injection in fetid discharges from the uterus, vagina, or rectum; as an application to cutaneous affections, especially scabies ; and as a local application to the skin in erysipelas; as an application to glandular swellings and sores of a scrofulous nature. It may be used also as an antidote in poisoning by sulphuretted hydrogen, sulphide of ammonium, and hydrocyanic acid, being given both internally and at the same time sprinkled in solution upon a cloth and held to the nostrils. It stands at the head of the list of general disinfectants, and for this purpose may be sprinkled upon the floor or be exposed in shallow open dishes, either in the solid form or in solution, in infected apartments.

Liquor Sodæ Chloratæ.—*Synonyms*: Solution of Chlorinated Soda —Hypochlorite of Soda—Chloride of Soda—Liqueur de Labarraque—Labarraque's Soda disinfecting liquid—a mixed Solution of Hypochlorite of Soda (NaO,ClO, or $NaClO$), Chloride of Sodium, and Bicarbonate of Soda.

PREPARATION.—*Take of carbonate of soda,* 12 *ounces; black oxide of manganese,* 4 *ounces; hydrochloric acid,* 15 *fluid ounces; distilled water,* 2 *pints. Dissolve the carbonate of soda in thirty-six fluid ounces of the distilled water, and put the solution into a glass vessel. Mix the oxide of manganese and hydrochloric acid in a glass flask, with a bent tube attached by means of a cork to its mouth, apply a gentle heat, and, with a suitable arrangement of apparatus, cause the gas which is evolved to pass first through a wash bottle containing four ounces of water, and then into the solution of carbonate of soda, regulating the heat so that the gas shall be slowly but constantly introduced. When the disengagement of chlorine has ceased, transfer the solution, in which it has been absorbed, to a stoppered bottle, and keep it in a cool and dark place.*

Rationale.—In the first place, chlorine gas is liberated from the ingredients placed in the retort, thus $4HCl + MnO_2 = MnCl_2 + 2H_2O + Cl_2$. The gas is washed by passing it through the intermediate bottle, and is then directed into the solution of carbonate of soda, when probably the following changes take place :—($2Na_2CO_3 + 2Cl + H_2O = 2NaHCO_3, + NaClO + NaCl$). The carbonate of soda, on the introduction of chlo-

rine, producing two equivalents of bicarbonate of soda, one equivalent of hypochlorite of soda, and one equivalent of chloride of sodium.

CHARACTERS.—*A colourless alkaline liquid, with astringent taste and feeble odour of chlorine. It decolorizes sulphate of indigo. It effervesces with hydrochloric acid, evolving chlorine and carbonic acid, and forming a solution which does not precipitate with perchloride of platinum.*

Differences of opinion exist as to the constitution of this preparation, but it is generally believed to be a mixed solution of bicarbonate of soda, hypochlorite of soda, and chloride of sodium. The presence of the bicarbonate of soda gives it an alkaline reaction, whilst the chlorine imparts to it the property of bleaching vegetable colours. On the addition of hydrochloric acid, chlorine and carbonic acid are evolved, and a solution is formed which does not precipitate with perchloride of platinum, indicating the absence of potash. It must be kept in a well-stoppered bottle, cool and dark, otherwise it will be decomposed, the chlorine escaping, and a deposition of crystals of carbonate of soda taking place. When carefully evaporated, the solution yields crystals, which, when redissolved, afford the solution as before.

PURITY TESTS.—*Specific gravity,* 1.103. *Seventy grains by weight added to a solution of twenty grains of iodide of potassium in four fluid ounces of water, and acidulated with two fluid-drachms of hydrochloric acid, require, for the discharge of the brown colour which the mixture assumes,* 500 *grain measures of the volumetric solution of hyposulphite of soda. It is not precipitated by oxalate of ammonia.*

The second of these tests shows that the preparation contains the proper quantity of chlorine 2·53 per cent. The principle of the test was fully explained under chlorinated lime. The third test shows that the solution of *chorinated lime* has not been substituted for chlorinated soda.

CATAPLASMA SODÆ CHLORATÆ—CHLORINE POULTICE.—*Take of solution of chlorinated soda,* 2 *fluid ounces; linseed meal,* 4 *ounces; boiling water* 8 *fluid ounces. Mix the linseed meal gradually with the water, and add the solution of chlorinated soda with constant stirring.*

Dose.—Internally min. xx to xxx in a wine-glassful of water; externally as a lotion, gargle, or injection, fl. dr. j to fl. drs. iv in fl. oz. vij of water; and also as the cataplasma sodæ chloratæ.
Antidotes—Same as for Calx Chlorata.

LIQUOR SODÆ CHLORATÆ, in large doses, acts as an irritant poison, causing inflammation of the mucous membrane, of the pharynx, œsophagus, stomach, and intestines, thereby producing difficulty of deglutition, hoarseness, vomiting, and purging: it causes tetanic spasms, and ultimately nervous exhaustion. Medicinally it is said to be a stimulant, astringent, tonic, alterative, and febrifuge, besides acting as an antiseptic and disinfectant. It is used both internally and externally for the same purposes and in a similar class of cases, as was mentioned under chlorine, chlorine water, and calx chlorata;

but for internal purposes, and in certain cases of local treatment, it is generally preferred to the solution of calx chlorata.

Group II. Liquid—Bromine.

BROMINE ($Br = 80$; βρῶμος, a stench). *Synonyms:* Brominium—Bromum—Brome—Brom—Muride. A liquid non-metallic element obtained from sea-water, and from some saline springs.

Preparation.—After all the salts that are capable of separation by crystallization have been removed from the mother liquor of sea-water, there still remains in it bromine, principally in the form of bromide of magnesium. In order to obtain bromine in its elementary form, the bromide is decomposed by subjecting the liquid to the influence of chlorine, which, seizing upon the magnesium to form chloride of magnesium, sets the bromine free, and thus allows it to impart its characteristic yellow colour to the liquid. ($Mg\ Br_2 + Cl_2 = Mg\ Cl_2 + Br_2$.) Sulphuric ether is next agitated with the liquid: this abstracts the bromine, and, when the mixture is left at rest, rises with it to the surface in the form of a reddish-brown liquid. The ethereal solution of bromine is separated from the mother liquor, and is agitated with a solution of hydrate of potash, whereby bromide of potassium and bromate of potash are formed in solution. The ether is then recovered, the salts of potash are dried by evaporation, and are exposed to a dull red heat, in order to convert, by deoxidation, the bromate of potash into bromide of potassium. The bromide is next mixed with peroxide of manganese, sulphuric acid, and water, and distilled into a cold receiver, where the orange coloured vapour is condensed into liquid bromine ($2H_2SO_4 + 2KBr + MnO_2 = K_2SO_4 + MnSO_4 + 2H_2O + Br_2$).

Characters.—*A dark brownish red, very volatile, liquid, with a strong and disagreeable odour. At the common temperature of the air it gives off red vapours, and at a temperature of* 117° *it boils.*

The odour of bromine, from which it derives its name, is very offensive. Its vapour resembles in colour that of peroxide of nitrogen, and causes great irritation when brought in contact with the living tissues. It is very heavy, having a specific gravity of 5·395, and with ammonia forms dense white fumes of bromide of ammonium. Bromine, like chlorine, bleaches certain vegetable colours in the presence of moisture, but when quite dry it does not remove their colour, so that its bleaching property is probably due to its affinity for hydrogen, the oxygen of the H_2O being set free to operate in its nascent state as a decolorizer. Bromine does not support combustion; it is but very slightly soluble in water, imparting to it a yellow colour; is more readily soluble in alcohol, and still more so in ether; it boils at 145°, and forms a red crystalline solid when reduced to a temperature of 19°. It combines with many of the metals to form bromides. It stains the skin yellow, and gives an orange-yellow colour with starch. It should be preserved under a layer of water in a stoppered bottle.

Tests.—*Specific gravity* 2·966. *Agitated with solution of soda in such proportion that the fluid remains very slightly alkaline; it forms a colour-*

less liquid, which, if coloured by the farther addition of a small quantity of the bromine, does not become blue on the subsequent addition of a cold solution of starch.

The object of this test is to detect iodine as an impurity; if present, it would yield the blue iodide of starch.

Dose.—Diluted with forty parts of water, it may be given in doses of min. v to viii in water. Externally, it may be applied as an aqueous solution of the strength of one part of bromine to ten parts of water; or, as an ointment, grs. x to xv to an ounce of lard, or in combination with bromide of potassium, like the corresponding preparations of iodine and iodide of potassium. For deodorising purposes the solution recommended by Dr Lawrence Smith, of Louisville, may be used—Bromine, 480 grains; bromide of potassium, 160 grains; distilled water, sufficient to make fl. oz. iv. This may also be used internally in doses of min. i to ij in water.

Antidotes.—Assist vomiting by plenty of diluents, to which should be added starch or substances containing it, such as flour, sago, arrowroot, &c., boiled in water, to produce bromide of starch; magnesia; milk; tepid water alone, until other remedies are procured. Subsequently combat local irritation and general excitement by opiate demulcents and counter-irritants.

Bromine in its elementary form is little used in medicine. It has been employed as a deodoriser, disinfectant, and antiseptic for the purification of hospitals during epidemics of smallpox, scarlatina, erysipelas, &c., and for similar purposes in cases of gangrene. Medicinally it may be said to occupy a position midway between chlorine and iodine, inclining rather more towards the former, and being relatively stronger than the latter. The vapour of bromine is exceedingly irritant, and in its pure state is irrespirable. When somewhat diluted it causes great irritation of the air passages, attended by dyspnœa, cough, hoarseness, and an increased flow of the secretions from the eyes, nose, and throat. In small doses it increases the appetite, improves generally the condition of the system, increases the flow of urine, imparts a stimulus to the lymphatic system, and tends to the removal of indolent glandular swellings. It acts partly by its topical irritant action, and partly by its absorption into the circulation. In larger doses it is irritant and caustic. In full poisonous doses bromine causes intense pain in the stomach and bowels, with difficult deglutition and dyspnœa, painful vomiting and purging, and ultimately fatal collapse. In large and continued doses it causes general debility and languor, with headache, colicky pains, diarrhœa, and sometimes salivation.

The cases in which solution of bromine has been used are those of a scrofulous character, in which it is both given internally and

applied locally, as to enlargement of the glands, to tumours of various kinds, and to scrofulous ulcers. Bromine has also been employed in affections of the spleen, in ventricular hypertrophy, in bronchocele, in eczema, and in carbuncle. It has been given in the amenorrhœa of scrofulous subjects, in croup, in aphthous affections, and in diphtheria; and it has been applied as an antidote against the bites of serpents, &c. But bromine is rarely used otherwise than in the form of one of its salts.

Bromide of Potassium (KBr). *Synonyms:* Potassii Bromidum —Hydrobromate of Potash—Bromure de Potassium—Brom Kalium—Kalium-Bromatum.

PREPARATION.—*Take of solution of potash, 2 pints; bromine, 4 fluid ounces, or a sufficiency; wood charcoal, in fine powder, 2 ounces; boiling distilled water, 1½ pint. Put the solution of potash into a glass or porcelain vessel, and add the bromine in successive portions, with constant agitation, until the mixture has acquired a permanent brown tint. Evaporate to dryness; reduce the residue to a fine powder, and mix this intimately with the charcoal. Throw the mixture in small quantities at a time into a red-hot iron crucible, and when the whole has been brought to a state of fusion, remove the crucible from the fire and pour out its contents. When the fused mass has cooled, dissolve it in the water, filter the solution through paper, and set it aside to crystallize. Drain the crystals, and dry them with a gentle heat. More crystals may be obtained by evaporating the mother liquor and cooling. The salt should be kept in a stoppered bottle.*

Rationale.—By the first part of the process the potash and bromine are converted into bromate of potash and bromide of potassium ($3K_2O + 6Br = KBrO_3 + 5KBr$). These salts are reduced to dryness by evaporation, and in the second part of the process the bromate of potash is deoxidized, and the whole is converted into bromide of potassium ($5KBr + KBrO_3 + 3C = 6KBr + 3CO$) the carbon uniting with the oxygen, and passing off as carbonic oxide.

CHARACTERS.—*In colourless cubical crystals, with no odour, but a pungent saline taste, readily soluble in water, less soluble in spirit. Its aqueous solution gives a white crystalline precipitate with tartaric acid.*[1] *When its solution in water is mixed with a little chlorine, chloroform agitated with it, on falling to the bottom, exhibits a red colour.*[2]

[1] Acid tartrate of potash, which proves it to be a salt of potash.
[2] Chloride of potassium being formed and bromine set free: if too much chlorine be added, chloride of bromine is formed, and the colour is destroyed.

PURITY TESTS.—*Ten grains require for complete decomposition 840 grain measures of the volumetric solution of nitrate of silver.*[1] *A solution of this salt, mixed with mucilage of starch and a drop of an aqueous solution of bromine or chlorine, does not exhibit any blue colour.*[2]

[1] Corresponding to 6·72 grains of bromine; if more be required, it is probably due to the presence of chloride of potassium, which is the most

common impurity of the bromine. [2] It would if iodide of potassium were present as an impurity. If hydrochloric acid gives a reddish colour, bromate of potash ($KBrO_3$) may be suspected.

Dose.—Internally, gr. x, xxx, or lx, dissolved in a suitable vehicle, twice or thrice a day. Externally, in the form of an ointment, either simple or compound made like the corresponding ointments of iodine and iodide of potassium.

The bromide of potassium has, within the last few years, become one of the most frequently used medicines. Though, no doubt, some properties have been attributed to it which it does not possess, yet it is unquestionably one of the most valuable recent additions to the materia medica. Introduced into medicine in this country by Dr R. Williamson in 1831, for the treatment of certain splenic and hepatic enlargements, it took little hold on the profession at large till recommended by Sir Charles Locock, in 1853, as the best treatment for hysterical epilepsy and nymphomania. Since that period, it has been gradually gaining ground, and the sphere of its applicability steadily widening.

Physiologically, it is a direct nervine sedative and depressant, having no preliminary period of excitement like opium and belladonna. It calms and slows the circulation generally, diminishes vascularity of the capillary network, and lessens heat production. It also exerts an anæsthetic effect upon tactile sensibility generally, but more especially upon the mucous membranes of the velum palati, the pharynx, the conjunctiva, and the urethra.

If the dose is very much increased (two drachms and upwards several times a-day), it produces such a degree of insensibility of the skin that it may be pinched and pricked without the subjects feeling pain, whilst there is developed great muscular weakness, the patient being unable to stand, and having the tottering gait of drunkenness; a degree of deafness and of weakness of vision is produced; also, intellectual languor, habitual weakness of memory, obtuseness of intellect, headache, and somnolence. This condition is known by the name of *bromism*, or *bromic intoxication.* It is, however, rarely developed; and later researches seem to prove that many symptoms which were wont to be referred to the action of bromine, such as coryza, lachrymation, frontal headache, and certain skin eruptions and boils, &c., ought to be referred to iodine, contained as an impurity in the bromide used in the experiments.

Therapeutically, it is employed as a sedative to allay irritation generally, as an anæsthetic, alterative, deobstruent, and anaphrodisiac:—

1. As a sedative, it is employed with the best results in the treatment of epilepsy (whether due to functional or organic cause), in puerperal convulsions, chorea, tetanus, laryngismus stridulus, hooping cough (when uncomplicated with chest disease), spasmodic asthma (functional or organic), cardiac palpitations, bronchitis, with painful cough, in irritable conditions of the pharynx and œsophagus; as a sedative and hypnotic in the pervigilia, so often the result of continued mental labour, in delirium tremens, in typhus and typhoid fever, &c.; as a sedative in neuralgic pains in the uterus, and to check profuse menstrual discharge, as it diminishes the amount of blood circulating in the pelvis.

2. As an anæsthetic, for furthering operations on the eye, on the velum palati, larynx, pharynx, œsophagus, and urethra; in painful rheumatic and gouty affections; in cephalalgia.

3. As an alterative, it has been recommended in secondary and tertiary syphilis, but the results are not good. It is of more use in strumous conditions, though in these it is inferior to the preparations of iodine.

4. As a deobstruent.—In glandular enlargements and visceral engorgements generally, it is of considerable use, but is better combined with iodide of potassium; in fibroid tumours of the uterus (Sir James Y. Simpson), in acute hydrocephalus, in which case, also, it is better combined with the iodide.

5. As an anaphrodisiac in nymphomania, satyriasis, spermatorrhœa, and chordee.

Bromide of potassium was found by Dr Begbie the most efficient remedy for cholera during the epidemic of the summer of 1866. He also found it lately of singular benefit in the treatment of diabetes mellitus.

It is probable that bromide of potassium acts by stimulating the vasomotor nerves to increased action, and that thereby it diminishes the vascularity of organs. In this respect, it differs from the iodide, which congests them. It is therefore suitable as a sedative and hypnotic to cases presenting the symptoms of cerebral congestion, and not those of anæmia. If the brain is anæmic, opium is a more suitable hypnotic. It is possibly owing to its diminishing the vascularity of the uterus that it is beneficial in fibroid tumours and dysmenorrhœa. In the treatment of epilepsy, M. Legrand du Saule states that no appreciable results need be expected with doses less than $1\frac{1}{2}$ drachms per diem, and it may often require to be raised to from 2 to $2\frac{1}{2}$ drachms a-day. Troublesome physiological results

need not be feared from the administration of pure bromide of potassium.

Bromide of Ammonium (NH_4Br)—AMMONII BROMIDUM.—May be prepared in the same manner as bromide of potassium, liquor ammoniæ being used instead of liquor potassæ.

CHARACTERS.—*In colourless crystals, which become slightly yellow by exposure to the air, and have a pungent saline taste. May be sublimed unchanged by the application of heat. Readily soluble in water, less soluble in spirit.*

PURITY TEST.—*A solution of the salt in water, mixed with mucilage of starch and a drop of an aqueous solution of bromine or chlorine, does not exhibit any blue colour.*[1]

[1] It would give a blue if iodine were present.

Dose.—One grain for each year of the child's age in hooping cough; for adults, v to xv grains thrice a day, in a suitable vehicle; or in occasional doses of xx or more grains.

The actions of bromide of ammonium are allied to those of the bromide of potassium, and it has been recommended in similar cases. It is besides reported to possess tonic virtues, and to reduce corpulency. It is less likely to induce bromism than the potassium salt, and it has the same specific effect on the mucous membranes of the throat, &c. It is used beneficially in hooping cough, in irritable sore throat, as a sedative gargle, and as an antidote to corpulency.

GROUP III. SOLID—IODINE, SULPHUR, CARBON, PHOSPHORUS.

IODINE (I=127; ἰώδης, *violet*, the colour of its vapour). *Synonyms:* Iodum—Iodinium—Iode—Iod.

A non-metallic element, obtained principally from the ashes of seaweed.

Preparation.—Iodine exists in minute quantity in sea-water, from which it is abstracted by the marine plants, from whose tissues it is obtained for commercial purposes. It is prepared to a large extent in Glasgow from *kelp* (the ashes of burned seaweed, chiefly *fuci* and *laminaria*) obtained from the Hebrides and Orkneys, and from the west coast of Ireland. The following is a sketch of the manufacturing process:—The seaweed sun-dried, and burned at a low heat, yields kelp, which is crushed, and then submitted to boiling water, which takes up about one-half of the substance. This solution is partially evaporated in open pans, whereby sulphates of potash and soda, carbonate of soda, and chloride of potassium are removed by crystallisation. The liquid that remains—called *mother liquor* or *iodine ley*—still contains sulphide of sodium, together with hyposulphite and carbonate of soda, and iodine in the form of *iodide of sodium*. In order to separate the iodine, sulphuric acid is first added to the iodine ley, and it is allowed to stand for twenty-four hours; during this period there is an escape of carbonic acid, sulphurous acid, and sulphuretted hydrogen gases, sulphate of soda being at the same time crystallised out and sulphur deposited. The supernatant liquor is next

transferred to a leaden retort, heated to 140°, and a quantity of black oxide of manganese, in powder, is added; from this mixture iodine is carefully and slowly distilled, and is received into a series of spherical glass condensers, connected with the conducting tube of the still. The changes which take place are probably these:—$2NaI + MnO_2 + 2H_2SO_4 = Na_2SO_4 + MnSO_4 + 2H_2O + I_2$.

CHARACTERS.—*Laminar crystals of a peculiar odour, dark colour, and metallic lustre, which, when heated, yield a beautiful violet-coloured vapour; very sparingly soluble in water, but freely dissolved by alcohol, by ether, and by a solution of iodide of potassium. The aqueous solution strikes a deep blue colour with starch.*

It may be obtained in the crystalline form of octohedra with rhombic bases, but more commonly it is met with in scales. Its odour somewhat resembles that of chlorine, and its taste is acrid; its colour is grey or bluish-black, being in colour and lustre not unlike plumbago. It volatilises at the ordinary temperature of the atmosphere (60° to 80°), but more rapidly at 120° to 130°, fuses at 225°, and boils at 347°. Its specific gravity, as a solid, is 4·947. Its vapour is of a rich violet colour, and has a specific gravity of 8·756. Water dissolves only about $\frac{1}{7000}$th part. Iodine stains the skin yellow or brown, is soft and friable, and is a non-conductor of electricity. It forms a blue iodide with starch.

PURITY TESTS.—*It sublimes without leaving any residue,*[1] *and the portion which comes first over does not include any slender colourless prisms emitting a pungent odour.*[2] 12·7 *grains dissolved in an ounce of water containing fifteen grains of iodide of potassium require for complete discoloration* 1000 *grain measures of the volumetric solution of hyposulphite of soda.*[3]

[1] Whatever remains is an impurity. [2] Iodide of cyanogen, the cyanogen being formed by the destruction of minute marine animals contained in the kelp. [3] The iodine is converted into the colourless iodide of sodium and tetrathionate of soda—($2Na_2S_2H_2O_4 + I_2 = 2NaI + Na_2S_4O_6, 2H_2O$.) The following substances have been met with as impurities in iodine—charcoal, binoxide of manganese, plumbago, coal, sulphide of antimony, iron, iodide of cyanogen, and water. The quantity of water present may be roughly estimated by the adherence of the iodine to the sides of the bottle on shaking it, or by pressing it between folds of blotting paper.

Dose.—Iodine is seldom administered in the pure form, but may be given in doses gradually increased from half-a-grain to a grain, in form of pill with a simple extract.

LINIMENTUM IODI.—LINIMENT OF IODINE.—*Take of iodine,* 1¼ *ounce; iodide of potassium,* ½ *ounce; camphor,* ¼ *ounce; rectified spirit,* 10 *fluid ounces. Dissolve the iodine and iodide of potassium and camphor in the spirit.*

The liniment is not used internally. It is scarcely, speaking strictly, a liniment, as it contains no oleaginous ingredient, except camphor, and therefore cannot be *rubbed in;* it is applied to the part by means of a camel's-hair brush, and usually is employed as a ready rubifacient and counter-irritant. Two or three applications are commonly sufficient for this purpose.

LIQUOR IODI.—*Solution of iodine.*

PREPARATION.—*Take of iodine,* 20 *grains; iodide of potassium,* 30 *grains; distilled water,* 1 *fluid ounce. Dissolve.*

This solution is a little more than $\frac{1}{3}$ the strength of the liniment, and nearly twice the strength of the tincture. For purposes of mild counter-irritation, it may be used externally for the liniment, and it may be substituted, on account of its cheapness, for the tincture for internal use. Dose, internally, min. v—xx.

TINCTURA IODI.—TINCTURE OF IODINE.—*Take of Iodine* $\frac{1}{2}$ *ounce; iodide of potassium,* $\frac{1}{4}$ *ounce; rectified spirit,* 1 *pint. Dissolve the iodine and the iodide of potassium in the spirit.*

The tincture may be given internally in doses gradually increased from min. x to xx or xxx, sufficiently diluted with water; but it is more commonly used as an external application, for which it is a mild preparation.

UNGUENTUM IODI.—OINTMENT OF IODINE.—*Take of iodine, iodide of potassium, of each,* 32 *grains; proof spirit,* 1 *fluid drachm; prepared lard,* 2 *ounces. Rub the iodine and the iodide of potassium well together, with the spirit, in a glass or porcelain mortar, add the lard gradually, and mix thoroughly.*

The iodine ointment is used as an external application to enlarged glands, &c. It was called compound ointment of iodine in the first edition of the British Pharmacopœia.

VAPOR IODIDI.—INHALATION OF IODINE.

PREPARATION.—*Take of tincture of iodine,* 1 *fluid drachm; water,* 1 *fluid ounce. Mix in a suitable apparatus, and having applied a gentle heat, let the vapour that arises be inhaled.*

This preparation is suitable for chronic pulmonary affections, such as bronchitis and phthisis, which are often benefited by the stimulating effect of inhaled vapour of iodine.

Antidotes.—An emetic: abundance of demulcent drinks containing starch, mucilage, or albumen; starch, flour, sago, arrowroot, boiled in water, to produce iodide of starch; white of egg, milk, carbonate of soda, and magnesia have been recommended. Subsequently allay local irritation and general excitement by bromide of potassium, opiate demulcents, and counter-irritants.

Topically, iodine acts as an irritant, causing more or less of local pain and general uneasiness, according to the strength and form of the preparation, and the delicacy of the structure to which it is applied. It stains the skin yellow or brown, and, according to the strength of the preparation or frequency of the application, either passes off, leaving the skin uninjured, or else causes its immediate vesication or gradual desquamation. When applied to serous and mucous membranes, as by injection into cavities, by inhalation, or by ingestion, it gives rise to irritation, varying in degree according to the quantity and strength of the preparation; when inhaled it may cause irritation of the respiratory mucous membrane, accompanied by distressing cough, coryza, and flow of tears; when taken

into the stomach, it may cause heat and constriction of the fauces and œsophagus, epigastric pain, vomiting, colic, salivation, &c.; when applied to serous membranes, it may either simply arrest their accustomed exhalations or give rise to adhesive inflammation. Constitutionally, iodine acts as an alterative, frequently removing the abnormal condition of the system for which it is employed, without displaying any remarkable physiological effects. It affects the glandular system, and renders the secreting organs more active. Considering the enormous quantity of iodine that is now administered, the instances in which it is reported to have produced untoward effects are comparatively rare, and, although formerly many objections were raised against it, exceptions are seldom taken to its use in suitable cases in the present day.

When iodine produces constitutional effects other than the merely silent removal of the malady for which it is administered, these may be manifested by symptoms either of active poisoning, or of a gradual interference with one or more of the functions of the body.

Fatal cases of poisoning by iodine are rare. The symptoms are those attending irritation and inflammation of the alimentary mucous membrane; namely, heat and constriction of the fauces and gullet, with intense thirst, violent pain in the stomach and bowels, which is aggravated by retching, vomiting, and purging, utter prostration, and fatal collapse. The quantity of iodine requisite to produce death in man varies with circumstances, and is undetermined; a large quantity, if promptly ejected by the stomach, might cause no ulterior effects; and the same quantity, if it met with a sufficiency of amylaceous substance in the stomach, might be rendered comparatively inert. Orfila produced very disagreeable consequences by swallowing four and a-half grains of solid iodine; but very much larger doses have been taken with impunity.

When iodine was first introduced into practice, many effects were attributed to its use which were probably mere coincidences, and not at all attributable to the drug. Without attempting, within the limited space of the *Note-Book*, to discriminate between the real and the supposed physiological effects of iodine, we may briefly enumerate the consequences that have, from time to time, been attributed to its use.

General emaciation is said to be caused by the use of iodine; but this effect is sometimes denied by those who call iodine a tonic, and state that patients improve in general appearance and grow fat during its exhibition. These statements are not irreconcilable; a

gentle irritation of the stomach, with slightly increased activity of the absorbents, not too long continued, may increase the appetite, promote assimilation, and conduce to *embonpoint;* but if the irritation be too severe, or too long continued, and the absorbents be too highly stimulated, the digestive functions may be impaired, and emaciation be the result; or the emaciation may in some cases be a mere coincidence, and be due to other causes. Atrophy of the mammæ and testicles is said to be caused by the use of iodine, but this is of comparatively rare occurrence, and is not well substantiated.

The presence of iodine in the system is sometimes manifested by a train of physiological symptoms to which the term *iodism* has been applied, except in those cases in which the phenomena are confined to the brain, when the state is called *iodic intoxication.* In the latter condition the patient suffers chiefly from frontal headache; his sight and hearing may be impaired, and the organs themselves may be the seat of considerable pain; in addition, he may have other neuralgic pains in the head and neck, and, in severe cases, there may be delirium with convulsions.

Iodism is comparatively a rare consequence of the legitimate use of the drug; it usually appears after iodine in one of its forms has been given in small doses for a considerable time; the symptoms are indicative both of local and constitutional effects; after premonitory symptoms of lassitude and loss of appetite, there is general pyrexia, accompanied by headache, vertigo, and coryza, a dry irritating cough, a frequent pulse, and a hot skin; derangement of the digestive organs, attended with nausea or vomiting and purging; cramps in the limbs or muscular tremor, with an ill-directed gait, gradual emaciation, extreme debility, with the characteristic small, weak, and frequent pulse, eyes sunken, countenance anxious, watchfulness or frightful dreams, palpitation, syncope, and ultimately death, if the poisoning be not arrested. These symptoms—which are present more or less in cases of iodism—cease almost immediately upon the disuse of the medicine.

Sometimes one or other of the foregoing physiological effects is alone manifested: in some patients *coryza* invariably follows the use of iodine, or even iodide of potassium. Headache, tinnitus aurium, or impaired vision, may ensue. A marked increase of appetite is a common result; diuresis frequently follows its use; irritation of the bowels, with diarrhœa, sometimes requires the addition of opium; salivation is occasionally a consequence, and also an enlarged and

fissured state of the tongue. When applied externally, not strong enough to cause vesication, the part may be left in an erythematous state, or it may be followed by a papular eruption, &c.

Iodine, in one or other of its forms, internally or externally, has been employed in the cure of more diseases than we have space even so much as to enumerate. Like many other remedies which have proved themselves trustworthy in certain maladies, it has suffered by being pressed into every kind of service. The diseases in which it has been of most use are those of a scrofulous or syphilitic character. Internally, and applied at the same time to the part, it is employed for the resolution of enlarged lymphatic glands, and for the healing and obliteration of scrofulous abscesses, ulcers, and cicatrices. In all cases complicated with scrofula, the treatment of each of which depends to a certain extent upon the part affected—as the eye, ear, joints, bones, &c.—the use of iodine, or the iodides, is indicated.

Internally, it is used with great advantage in the treatment of syphilis, in cases and in stages of the disease in which mercury is inadmissible, or has been used unavailingly ; externally, it is applied to syphilitic nodes, &c. Both internally and externally, it has been recommended in hypertrophies of a sub-inflammatory origin, in indurations, and ulcers of the breast, tongue, tonsils, ovary, uterus, &c. In many obstinate chronic cutaneous diseases, more especially if referable to syphilitic, arthritic, or strumous cause, it is of undoubted benefit. In phthisis, and chronic bronchitis, it has been recommended both in the solid form of the several iodides, and also in the form of iodine inhalation. In tubercular meningitis, in acute, subacute, and chronic rheumatism, in gonorrheal rheumatism, and in rheumatic gout, in catamenial disorders, leucorrhœa, and chlorosis, in affections of the liver and spleen, in chronic and subacute inflammations of serous membranes, as in pleurisy and peritonitis, in the kidney affection of scarlatina, as a substitute for nitrate of silver in erysipelas, as an injection into encysted tumours, in the radical cure of hydrocele, in various dropsies, and in very many more diseases, either given internally to act as an alterative and deobstruent, externally to act as a counter-irritant, discutient, or escharotic, or injected into cavities for the purpose of procuring their obliteration by setting up adhesive inflammation, iodine, in one or another of its forms, has been recommended.

In the cure of *goitre* or bronchocele, burned sponge and other remedies, as certain mineral springs, were used before it was known

that they contained iodine ; for the cure of this disease iodine is now most successfully used both internally and externally.

In acute inflammatory and febrile attacks, especially where there is an irritable condition of the alimentary mucous membrane, the preparations of iodine are generally contra-indicated.

Iodide of Starch (AmI). *Synonyms:* Aymli Iodidum—Amylum Iodatum — Iodised Starch. Was introduced by Dr Buchanan, of Glasgow, and may be prepared by rubbing twenty-four grains of iodine, moistened with a little spirit or water, with an ounce of finely powdered starch, the latter being gradually added until the mixture assumes a uniform blue colour ; it is then carefully dried by a gentle heat, so as not to drive off the iodine, and the powder is preserved in a well-stoppered bottle. The object of this preparation was to administer iodine in large doses without producing gastric irritation or other symptoms of iodism. It is given in doses of half a drachm, gradually and cautiously increased, thrice daily. Dr Buchanan began with half-ounce doses, and gradually increased to an ounce, thrice daily, *i.e.*, upwards of seventy grains of iodine daily. Although often well borne in these doses, it is not unattended with danger. It is used in the same cases as iodine.

Iodide of Potassium (KI). *Synonyms:* Potassii Iodidum—Kalium Iodatum — Hydriodate of Potash — Ioduret of Potassium — Iodure de Potassium—Iod Kalium.

Preparation.—*Take of solution of potash,* 1 *gallon; iodine, in powder,* 29 *ounces, or a sufficiency; wood charcoal, in fine powder,* 3 *ounces; boiling distilled water, a sufficiency. Put the solution of potash into a glass or porcelain vessel, and add the iodine in small quantities at a time with constant agitation, until the solution acquires a permanent brown tint. Evaporate the whole to dryness in a porcelain dish, pulverise the residue, and mix this intimately with the charcoal. Throw the mixture, in small quantities at a time, into a red-hot iron crucible, and, when the whole has been brought to a state of fusion, remove the crucible from the fire and pour out its contents. When the fused mass has cooled, dissolve it in two pints of boiling distilled water, filter through paper, wash the filter with a little boiling distilled water, unite the liquids, and evaporate the whole till a film forms on the surface. Set it aside to cool and crystallise. Drain the crystals, and dry them quickly with a gentle heat. More crystals may be obtained by evaporating the mother liquor and cooling. The salt should be kept in a stoppered bottle.*

Rationale.—By the first part of the process the potash and iodine are converted into iodate of potash and iodide of potassium ($3K_2O + 6I = KIO_3 + 5KI$). These salts are reduced to dryness by evaporation, and in the second part of the process the iodate of potash is deoxidised, and the whole is converted into iodide of potassium ($5KI + KIO_3 + 3C = 6KI + 3CO$), the carbon uniting with the oxygen and passing off as carbonic oxide.

Characters.—*In colourless, generally opaque, cubic crystals, readily soluble in water, and in a less degree in spirit. It commonly has a feeble alkaline reaction; its solution mixed with mucilage of starch gives a blue*

colour on the addition of a minute quantity of solution of chlorine.[1] *It gives a crystalline precipitate with tartaric acid.*[2]

[1] The chlorine is necessary to combine with the potassium, thus setting free the iodine ($KI + Cl = KCl + I$), and blue iodide of starch is then formed, proving it to be an iodine salt. [2] Acid tartrate of potash is formed, proving it to be a potash salt.

The crystals may also be quadrangular prisms or octohedra, but more commonly cubes, and frequently the sides of the cubes are excavated; when carefully prepared, the crystals are transparent; they are inodorous, of an acrid, saline, and afterwards slightly bitter taste; permanent in dry atmosphere, but deliquesce in a moist atmosphere; soluble in three-fourths their weight of cold water, and in half their weight of hot water; decrepitate when heated, fuse at a low red heat, and volatilise without decomposition; they facilitate the solution of iodine both in water and alcohol, the compound being termed ioduretted iodide of potassium.

PURITY TESTS.—*The addition of tartaric acid and mucilage of starch to its watery solution does not develop a blue colour.*[1] *Solution of nitrate of silver added in excess forms a yellowish-white precipitate, which, when agitated with ammonia, yields by subsidence a clear liquid, in which excess of nitric acid causes no turbidity.*[2] *Its aqueous solution is only faintly precipitated by the addition of saccharated solution of lime.*[3]

[1] Showing the absence of *iodate of potash* as an impurity; if the iodate were present, the following changes would take place:—On the addition of tartaric acid to the solution, acid tartrate of potash and hydriodic acid are formed; the hydriodic acid and the iodate of potash, reacting upon each other, are resolved into iodide of potassium, water, and free iodine ($6HI + KIO_3 = 3H_2O + KI + I_6$), the latter of which gives the blue iodide with the starch. [2] Showing the absence of chlorides of potassium and sodium as impurities; on the addition of the nitrate of silver, *iodide* of silver is precipitated, and if chlorides be present, *chloride* of silver will also be precipitated; the ammonia cannot dissolve the *iodide*, but it would take up the *chloride*, if present, and would hold it in solution until affected by excess of nitric acid, when the solution would become turbid. [3] Showing the absence of carbonates.

The chief impurities of iodide of potassium are water, carbonate of potash, iodate of potash, chlorides of potassium or sodium, sulphates of potash, soda, or lime, a free alkali, &c. Water may be detected by loss of weight when heated; it may be either an original impurity or be obtained by deliquescence; the sulphates would give with solution of chloride of barium a white precipitate insoluble in nitric acid; a free alkali would turn turmeric paper brown, but "it commonly has a feebly alkaline reaction."

Dose of Iodide of Potassium.—The dose ranges to a wide extent, even from two grains to half-a-drachm; commonly, from three to ten grains, thrice daily, in simple water or bitter infusions.

UNGUENTUM POTASSII IODIDI.—*Ointment of iodide of potassium. Take of iodide of potassium,* 64 *grains; carbonate of potash,* 4 *grains; distilled water,* 1 *fluid drachm; prepared lard,* 1 *ounce. Dissolve the iodide of potassium and carbonate of potash in the water, and mix thoroughly with the lard.*

This ointment is used as an application to glandular enlargements; being colourless, it may be applied to exposed parts without disfiguring the patient.

Antidotes.—Same as mentioned under Iodine.

Iodide of potassium may give rise to the physiological symptoms collectively termed *iodism*, but being less irritant than pure iodine, it does not generally produce any marked symptoms. Coryza appears to be the most common physiological manifestation of its action, sometimes attended by swelled face. Salivation, emaciation, general or local, gastric irritation, with vomiting and purging, headache, &c., may also result from its use. But it is often given in large and long-continued doses without producing any untoward effects.

Iodide of potassium is more frequently given internally than any other preparation of iodine; and it has been recommended in the diseases mentioned under iodine, of which it possesses all the alterative, discutient, and deobstruent virtues. It is often beneficially administered in combination with bromide of potassium, with which it agrees in deobstruent action, but differs in congesting the capillary circulation and acting as a general stimulant; while the bromide acts as a general and nervine sedative, and tends to diminish the capillary congestion.

In the treatment of *internal aneurism* it has lately been found exceedingly useful in alleviating the sufferings of the patients, and even in promoting a cure by consolidation of the tumour. The iodide of potassium is the most valuable agent we have in the treatment of tertiary syphilis. It is also of use in the secondary stage of that disease. It is most effective in removing the pains of syphilitic nodes, and pains of all kinds referable to syphilitic tissue change. It is sometimes useful in sciatica, lumbago, cephalalgia, and chronic rheumatism. It is of signal benefit in diseases of the liver, kidneys, spleen, and of internal organs generally, if the disease is associated with syphilis. It has been used successfully for the elimination of lead and mercury in cases of chronic poisoning by these substances; the iodide renders them soluble, and at first the symptoms of poisoning may be aggravated in consequence, but ultimately the patient is relieved. It is, however, necessary to prescribe iodide of potassium with great care to a patient who has been taking mercury recently, because injurious salivation is liable to occur in a certain proportion of cases.

Linimentum Potassii Iodidi cum Sapone—Liniment of the Iodide of Potassium and Soap.

PREPARATION.—*Take of hard soap, cut small, iodide of potassium, of each* $1\frac{1}{2}$ *ounce; glycerine,* 1 *fluid ounce; oil of lemon,* 1 *fluid drachm; distilled water,* 10 *fluid ounces. Dissolve the soap in* 7 *fluid ounces of the water by the heat of a water-bath. Dissolve the iodide of potassium and glycerine in the remainder of the water, and mix the two solutions together. When the mixture is cold, add the oil of lemon, and mix the whole thoroughly.*

A liniment applicable to the cases in which iodide of potassium is used externally. But it is very doubtful if that salt is ever of any real service as an outward application. It may be used in cases of swollen glands or in inflammatory swellings, &c.

Iodide of Sodium (NaI). *Synonyms:* Sodii Iodidum—Hydriodate of Soda. This compound is found in the mother liquor of kelp: it may be prepared by adding iodine to a solution of caustic soda, evaporating the solution and fusing the residue; or from iron filings, iodine and carbonate of soda, iodide of iron being first formed, which, by a mutual decomposition with the carbonate of soda, affords carbonate of iron precipitated, and iodide of sodium in solution. The solution is carefully evaporated and the salt crystallised. At ordinary temperatures it crystallises in striated, oblique, rhombic prisms, which are transparent, and contain two atoms of water; but when crystallised at a temperature above 100°, it forms anhydrous cubes. The crystals readily deliquesce, and are decomposed when exposed to the atmosphere. Its taste is not so disagreeable as that of iodide of potassium, and it is said to be more readily borne, and to cause less frequently the symptoms of iodism than that salt. It may be given in somewhat larger doses, as of from five to twenty grains. It is used in the same cases as iodide of potassium.

Iodide of Ammonium (NH_4I). *Synonyms:* Ammonii Iodidum—Hydriodate of Ammonia—Ammonium Iodatum. May be prepared by adding caustic ammonia in excess to hydriodic acid, or by adding iodine to a solution of hydrosulphuret of ammonia, and in both cases evaporating to crystallisation. Or it may be made by first preparing iodide of iron and decomposing it by the addition of solution of ammonia, hydrated peroxide of iron being precipitated, and iodide of ammonium left in solution, which on evaporation yields the salt. It is met with either in cubic crystals, or as a white crystalline powder; the constituents are not strongly combined, and decomposition readily takes place. It has a taste of iodine, and when pure is inodorous, but on exposure to air it emits an iodine odour. It readily deliquesces, and evolves ammonia. It has been used in medicine as a substitute for iodide of potassium in scrofulous and syphilitic affections; its actions are like those of the corresponding potash salt, but it is more irritant. Dose, two to four or more grains thrice daily: topically as an ointment.

The tincture of iodine may be decolorized by agitating two parts of it with one part of liquor of ammoniæ; a colourless ammoniated tincture is produced, which, for external use, has the advantage of not disfiguring the patient.

Iodide of Sulphur (S_2I, or SI). *Synonyms:* Sulphuris Iodidum—Sulphur Iodatum.

PREPARATION.—*Take of iodine,* 4 *ounces; sublimed sulphur,* 1 *ounce. Rub them together in a wedgwood mortar until they are thoroughly mixed. Put the mixture into a flask, close the orifice loosely, and apply a gentle heat, so that the colour of the mass shall become gradually darkened. When the colour has become uniformly dark throughout, increase the heat so as to produce liquefaction. Then incline the flask in different directions, in order to return into the liquid any portion of the iodine which may have been condensed on the inner surface of the vessel. Lastly, withdraw the heat; and when the liquid has congealed, remove the mass by breaking the flask, reduce it to pieces, and keep these in a well-stopped bottle.*

Under the action of the heat the iodine and sulphur unite, forming a subiodide of sulphur, SI.

CHARACTERS.—*A greyish-black solid substance, with a radiated crystalline appearance.*

TESTS.—*It resembles iodine in smell, and in the property of staining the cuticle when applied to it. Soluble in about* 60 *parts of glycerine; insoluble in water, but decomposed when boiled with it. If* 100 *grains be thoroughly boiled with water, the iodine will pass off in vapour, and about* 20 *grains of sulphur will remain.*

It occurs in the form of sub-crystalline, radiated plates of a dark-grey or brownish colour, and of metallic appearance. Its constituents are but loosely combined, and are readily separated by a gentle heat, the iodine first passing off in violet vapours, and ultimately the sulphur is also sublimed. It has an acrid taste, and the odour of iodine.

Ointment of Iodide of Sulphur—Unguentum Sulphuris Iodidi.

PREPARATION.—*Take of iodide of sulphur,* 30 *grains; prepared lard,* 1 *ounce. Triturate the iodide of sulphur in a porcelain mortar, and gradually add the lard, rubbing them together until the ointment is perfectly smooth and free from grittiness.*

This preparation has been occasionally used as an alterative internally in doses of from one to six grains, and as vapour inhalation in cases of chronic bronchitis with emphysema. In the latter affection Dr Copland states that he has seen temporary advantage accrue from its use. Its chief employment is, however, externally as a stimulant and deobstruent application in squamous and tubercular forms of skin disease. It has been found advantageous in acne indurata and rosacea, in herpes labialis pustulosus, in chronic eczema, and psoriasis. It is applied in the form of ointment prepared as above.

Iodide of Lead (PbI, or PbI_2). *Synonyms:* Plumbi Iodidum—Plumbum Iodatum—Iodure de Plomb—Iod-Blei.

PREPARATION.—*Take of nitrate of lead, iodide of potassium, of each* 4 *ounces; distilled water, a sufficiency. Dissolve the nitrate of lead, by the aid of heat, in* 1½ *pint, and the iodide of potassium in* ½ *pint of the water, and mix the solutious. Collect the precipitate on a filter, wash it with distilled water, and dry it at a gentle heat.*

Iodide of Lead Plaster—Emplastrum Plumbi Iodidi.

PREPARATION.—*Take of iodide of lead,* 1 *ounce; soap plaster, resin, of each* 4 *ounces. Add the iodide of lead in fine powder to the plasters, previously melted, and mix them intimately.*

Ointment of the Iodide of Lead—Unguentum Plumbi Iodidi.

PREPARATION.—*Take of iodide of lead in fine powder,* 62 *grains; simple ointment,* 1 *ounce. Mix thoroughly.*

Rationale.—When the iodide of potassium is added to the solution of nitrate of lead, double decomposition takes place, insoluble iodide of lead being precipitated, and nitrate of potash remaining in solution. The reaction is thus — $Pb2NO_3 + 2KI = 2KNO_3 + PbI_2$. It occurs either in glittering yellow scales, or as a deep golden-yellow powder, inodorous and tasteless, readily dissolved by boiling water, but scarcely soluble in cold. It is also soluble in potash, in acetic acid, in alcohol, and in ether. The iodide is deposited from its aqueous solution on the cooling of the water in the form of brilliant glistening scales. The aqueous solutions are colourless. Heat drives off the iodine in violet vapours.

Iodide of lead is seldom given internally, and it is still undetermined whether its characteristic actions incline more towards the iodine or towards the lead of its constitution. It has been given internally in doses of from half-a-grain to two, three, or more grains, in the form of a pill: but it is chiefly used as an external application in the forms of the ointment and plaster. It is said to be beneficial as an application to cancerous tumours, to scrofulous affections of the glands, joints, &c., and to chronic cutaneous affections, especially those of the scalp. Internally it has been recommended in affections of the spleen.

Iodide of Cadmium (CdI or CdI_2). *Synonyms:* Cadmii Iodidum —Cadmium Iodatum.

PREPARATION.—*It may be formed by direct combination of iodine and cadmium in the presence of water.*

CHARACTERS.—*In flat micaceous crystals, white, of a pearly lustre, which melt when heated to about* 600°, *forming an amber-coloured fluid. At a dull-red heat violet-coloured vapours are given off. It is anhydrous and permanent in air; freely soluble in water and in rectified spirit. The solution reddens litmus paper.*

TESTS.—*The aqueous solution gives a yellow precipitate with sulphuretted hydrogen or sulphide of ammonium, which is insoluble in excess of the latter.*[1] *The solution also gives off a white gelatinous precipitate with excess of solution of potash, the filtrate from which is unaffected by sulphide of ammonium.*[2] 10 *grains dissolved in water and nitrate of silver added in excess give a precipitate which, when washed with water and afterwards with half-an-ounce of solution of ammonia and dried, weighs* 12·5 *grains.*[3]

[1] Separates it from arsenic. [2] Separates from salts of zinc and tin, which are soluble in excess of the potash, and would appear in the filtrate. [3] Proves that the substance is composed entirely of CdI_2, as this is the proportion of iodide of silver which ought to be formed from 10 grains of iodide of cadmium.

Unguentum Cadmii Iodidi.—Ointment of Iodide of Cadmium.

PREPARATION.—*Take of iodide of cadmium in fine powder, 62 grains; simple ointment, 1 ounce. Mix thoroughly.*

The iodide of cadmium, in form of ointment, has been used as a stimulating friction application to scrofulous glands, chronic inflammation of joints, nodes, chilblains, and certain cutaneous eruptions It was introduced by Dr Garrod. It has the advantage over iodide of lead, with which it agrees in action, that it does not stain the skin yellow, and there is no danger of poisoning by absorption.

Iodide of Iron (FeI, or FeI_2). *Synonyms:* Ferri Iodidum—Protoiodide of Iron—Iodure de Fer—Eisen Iodur.

Iodide of iron, with about 18 per cent. of water of crystallisation, and a little oxide of iron.

PREPARATION.—*Take of fine iron wire,* 1½ *ounce; iodine,* 3 *ounces; distilled water,* 15 *fluid ounces. Put the iodine, iron, and twelve ounces of the water into a flask, and having heated the mixture gently for about ten minutes, raise the heat and boil until the froth becomes white. Pass the solution as quickly as possible through a wetted calico filter into a dish of polished iron, washing the filter with the remainder of the water, and boil down until a drop of the solution taken out on the end of an iron wire solidifies on cooling. The liquid should now be poured out on a porcelain dish, and, as soon as it has solidified, should be broken into fragments, and enclosed in a well-stoppered bottle.*

Rationale.—The iodine and iron simply unite to form the iodide of iron, and then combine with four atoms of water (FeI_24H_2O). The preparation is prone to change, by the decomposition of its water, and the absorption of oxygen from the atmosphere. It is to obviate this tendency during the *boiling down* that "a dish of polished iron" is directed to be used, which, by providing additional iron, prevents that of the preparation being converted into peroxide and periodide. When exposed to the atmosphere, the iodide readily decomposes, the iron being at first partially oxidised from the water, and then more fully from the atmosphere; peroxide of iron and hydriodic acid ($Fe_2O_3 + HI$) are formed, and the latter by the absorption of oxygen is further changed into water and free iodine ($2HI + O = H_2O + I_2$).

CHARACTERS.—*Crystalline, green with a tinge of brown, inodorous, deliquescent, almost entirely soluble in water, forming a slightly green solution, which gradually deposits a rust-coloured sediment, and acquires a red colour.*[1] *Its solution gives a copious blue precipitate with the red prussiate of potash;*[2] *mixed with mucilage of starch, it acquires a blue colour on the addition of a minute quantity of solution of chlorine.*

It has an acrid, astringent, or styptic taste. It is readily soluble in water and alcohol, from which, by careful evaporation, it may be obtained in green tabular crystals. The solution, when fresh, is of a

green colour, slightly acid, and not unpleasant taste when sufficiently diluted : but it readily decomposes, yielding a rust-coloured sediment of peroxide of iron mixed with periodide, the fluid at the same time turning red from the presence of free iodine.[1] [2] This proves it to be a *proto*-salt of iron. [3] The chlorine by displacing the iodine sets it at liberty to form blue iodide of starch, which proves the presence of iodine. The decomposition of the solution is prevented by the presence of sugar, so that the iodide can be well kept in the form of syrup. The solution can also be preserved by immersing a coil of iron wire in it, with part of which any free iodine would recombine to form iodide ; but this does not prevent the deposition of peroxide of iron. The solid iodide may be preserved by covering it with a layer of pulvis ferri, and without this precaution, even in a well-stoppered bottle, it would be spoiled by the decomposition of its water. Gently heated, the iodide fuses ; at a higher temperature, it volatilises, evolving violet vapours of iodine, and leaving a residue of peroxide, periodide, and iodide of iron ; when heated to redness, the iodine is entirely driven off, and nothing but oxide of iron remains.

It is not subject to wilful adulteration, and any change by decomposition will be detected by the characters of a good preparation.

Dose.—The iodide of iron may be given in doses of two to five or more grains, gradually increased, either dissolved in water, in cod-liver oil, when that is suitable to the patient, in syrup, or in pill.

PILULA FERRI IODIDI—Pill of Iodide of Iron.—*Take of fine iron wire,* 40 *grains ; iodine,* 80 *grains ; refined sugar, in powder,* 70 *grains ; liquorice root, in powder,* 140 *grains ; distilled water,* 50 *minims. Agitate the iron with the iodine and the water in a strong stoppered ounce phial until the froth becomes white. Pour the fluid upon the sugar in a mortar, triturate briskly, and gradually add the liquorice.*

When freshly prepared, about three grains of the mass will contain a grain of iodide of iron.

Dose.—Gr. j. to v.

SYRUPUS FERRI IODIDI—Syrup of Iodide of Iron.—*Take of fine iron wire,* 1 *ounce ; iodine,* 2 *ounces ; refined sugar,* 28 *ounces ; distilled water,* 13 *fluid ounces. Prepare a syrup by dissolving the sugar in ten ounces of the water with the aid of heat. Digest the iodine and the iron wire in a flask, at a gentle heat, with the remaining three ounces of the water, till the froth becomes white ; then filter the liquid while still hot into the syrup, and mix. The product should weigh two pounds eleven ounces, and should have the specific gravity* 1·385.

It contains 4·3 *grains of iodide of iron in one fluid drachm.*

Dose.—Min. xv. to lx.

Iodide of iron unites the tonic and chalybeate properties of iron with the alterative and deobstruent action of iodine, and its use is indicated in those cases of scrofula and anæmia for the individual cure of which these constituents are separately administered. It is apt to cause local irritation if given in too large doses at first, or when too long-continued : vomiting, catharsis, or diuresis may follow

in such cases ; also the head symptoms which sometimes arise during the exhibition of chalybeates. It is given as an alterative and tonic to scrofulous children ; as an emmenagogue to women of similar constitution, affected with irregularities of the catamenia, leucorrhœa, and other functional and organic diseases of the uterus and ovaries ; in chlorosis, in secondary syphilis, in phthisis, in albuminuria, in diabetes, in chronic cutaneous diseases, in debilitated scrofulous patients, &c. Iodide of iron is placed in this group because it is more of an iodine than of a ferruginous medicine ; the proportion of iodine to iron being as 4·5 to 1. The iodides of arsenic, mercury, gold, &c., will be found under the respective metals.

IODOFORM (CHI_3). *Syn. :* Iodoformum—Teriodide of Formyl. This substance may be prepared by gradually adding chlorinated lime to an alcoholic solution of iodide of potassium heated to 104°, and stirring after each additional portion of the lime is added, till the liquid ceases to assume a dark-red colour. On cooling, iodate of lime and iodoform are precipitated in confused crystalline masses, and the iodoform is then dissolved out with boiling alcohol. From this solution the iodoform is deposited in small, pearly, yellow crystals, with an odour of saffron and a sweet taste.

Iodoform is insoluble in water, but soluble in alcohol, ether, chloroform, and the fatty and volatile oils. It is, however, most soluble in bisulphide of carbon. It possesses no irritant action, though it contains nine-tenths of its weight of iodine. It exercises a marked anæsthetic action. It proves poisonous to the lower animals in smaller doses than iodine. It possesses the general deobstruent and alterative properties of iodine without having its local inconvenient effects, and has been used in syphilis, scrofula, goitre, and glandular enlargements. Externally, in scaly skin diseases, as an anodyne application to malignant tumours, and to inflammatory, rheumatic, or gouty painful swellings generally. As a suppository in chronic enlargement of the prostate gland.

Dose.—Internally, two to three grains in pill, thrice daily. Externally, as an ointment, one drachm to one ounce of lard. As a suppository, twenty grains to a sufficiency of the menstruum.

SULPHUR ($S=8$, or 16, *sal*, salt, and πῦρ, fire). *Synonyms :* Brimstone — Soufre — Schwefel. Sulphur enters into the constitution of certain organic structures both of the animal and vegetable kingdom. It enters into the composition of the albuminoid or proteic compounds, and is met with in certain essential oils, such as those of mustard and horse-radish. In the mineral kingdom it occurs in the native or uncombined state either in a crystallised or amorphous form, chiefly in the vicinity of volcanoes. In combination with metals it is abundantly distributed in the form of pyrites. Iron pyrites (bisulphide of iron) contains about 54 per cent. of sulphur, and from this sulphur may be obtained by distillation, but when thus prepared it is less pure than native sulphur, and is apt to contain arsenic. Sulphur is met with also in certain mineral springs, and in the oxidised condition of sulphuric

acid it is found as a natural product in combination with various earths. The sulphur of commerce is chiefly derived from Sicily, where it is met with in the native form in beds. It is afterwards refined by distillation and sublimation, and is known by the names of *stick, roll, sublimed,* or *flowers of* sulphur, according to the process of its purification.

Sulphur is met with either as a gritty powder (*flowers of sulphur*), as round sticks or rolls (*roll sulphur,* or *common brimstone*), or in crystals whose primitive form is the octohedron with a rhombic base; but the crystalline form of sulphur varies according to the circumstances, especially that of temperature, under which the crystals are produced. In masses, it is opaque, pale yellow, brittle, of insipid taste, and of somewhat peculiar odour when rubbed. It is a non-conductor of heat and electricity, becoming negatively electrical by heat and friction. It crackles and falls to pieces, in consequence of unequal expansion, when grasped in a warm hand. Its specific gravity is 1·970 to 2·080. It is highly inflammable, ignites at 450° to 500°, and burns with a blue flame, evolving the suffocating fumes of sulphurous acid; it begins to volatilise at about 180°, melts at 239°, boils about 752°, and assumes a variety of forms both during the increase of temperature and also according to the manner in which it is cooled again. It is insoluble in water, and scarcely soluble in alcohol, ether, or chloform.

Sulphur Sublimatum. *Synonyms:* Sublimed Sulphur—*Flowers of Sulphur*—Sulphur Lotum (*when washed*).

CHARACTERS.—*A slightly gritty powder of a fine greenish-yellow colour; without taste, and without odour, unless heated; burning in open vessels with a blue flame and the evolution of sulphurous acid.*

PURITY TESTS.—*Entirely volatilised by heat;*[1] *does not redden moistened litmus paper.*[2] *Solution of ammonia, agitated with it, and filtered, does not on evaporation leave any residue.*[3]

[1] Absence of fixed impurities. [2] Absence of sulphurous and sulphuric acids, which might be formed by combination of the sulphur with oxygen during the process of sublimation, and not afterwards entirely removed by washing. [3] There would be a yellow residue if arsenic were present, a not unlikely impurity of sulphur obtained from pyrites, but not of native sulphur.

Sulphur Præcipitatum. *Synonyms:* Precipitated Sulphur—Milk of Sulphur—*Lac Sulphuris.*

PREPARATION.—*Take of sublimed sulphur, 5 ounces; slaked lime, 3 ounces; hydrochloric acid, 8 fluid ounces, or a sufficiency; distilled water, a sufficiency. Heat the sulphur and lime, previously well mixed, in a pint of the water, stirring diligently with a wooden spatula; boil for fifteen minutes, and filter. Boil the residue again in half-a-pint of the water, and filter. Let the united filtrates cool, dilute with two pints of the water, and, in an open place or under a chimney, add in successive quantities the hydrochloric acid, previously diluted with a pint of the water, until effervescence ceases and the mixture acquires an acid reaction. Allow the precipitate to settle, decant off the supernatant liquid, pour on fresh distilled water, and continue the purification by affusion of distilled water and subsidence, until the fluid ceases to have an acid reaction and to precipitate with oxalate of*

ammonia. Collect the precipitated sulphur on a calico filter, wash it once with distilled water, and dry it at a temperature not exceeding 120°.

Rationale.—In the first part of the process the sulphur and lime unite to form sulphuret (or sulphide) of calcium and hyposulphite of lime, both of which are soluble in water, and are contained in the *united filtrates.* On the addition of hydrochloric acid, these compounds are decomposed, sulphur is precipitated, chloride of calcium left in solution, and sulphuretted hydrogen evolved. It is to obviate the injurious effects of the latter that the process is directed to be conducted in an open place, or under a chimney. A precipitate with oxalate of ammonia would indicate the presence of lime.

CHARACTERS.—*A greyish-yellow soft powder, free from grittiness, and from the smell of sulphuretted hydrogen. When heated in an open vessel, it burns with a blue flame and the evolution of sulphurous acid.*

PURITY TESTS.—*Entirely volatilised by heat; under the microscope it is seen to consist of opaque globules without any admixture of crystalline matter. Otherwise, it corresponds with sublimed sulphur.*

When carefully prepared, this is a very good form of sulphur for medicinal purposes; but it is so liable to adulteration, especially with sulphate of lime, from the use of sulphuric instead of hydrochloric acid in the preparation, that it was for a long time little used. Samples have been purchased containing as much as two-thirds by weight of sulphate of lime. The above tests are intended to detect this adulteration.

Dose.—Sublimed or precipitated sulphur may be given in doses of ten to twenty or thirty grains as a stimulant; as a laxative, half a drachm to two drachms, or more, in treacle, syrup, milk, or confection.

CONFECTIO SULPHURIS.—CONFECTION OF SULPHUR.—*Take of sublimed sulphur,* 4 *ounces; acid tartrate of potash, in powder,* 1 *ounce; syrup of orange peel,* 4 *fluid ounces. Rub them well together.*

Dose.—As a laxative, one to two drachms once or twice a-day; a teaspoonful or more morning and evening.

UNGUENTUM SULPHURIS.—OINTMENT OF SULPHUR.—*Take of sublimed sulphur,* 1 *ounce; benzoated lard,* 4 *ounces. Mix thoroughly. For external use* ad lib.

Sulphur acts as a stimulant, diaphoretic, and laxative. In small doses (ten to twenty grains) frequently repeated, it stimulates the secreting organs, especially the skin and mucous membranes. In larger doses (a drachm and upwards) it acts as a gentle laxative, producing semi-liquid evacuations without pain or constitutional disturbance; its laxative effects are produced either by increasing the peristaltic action of the bowels, or by increasing the secretion from the mucous membrane of the intestines. A considerable quantity of the sulphur taken internally is carried off unchanged by the bowels, but part of it is absorbed into the circulation, and is eliminated partly in the form of sulphuric acid by the kidneys, and

partly as sulphuretted hydrogen by the skin, the latter having the effect of blackening silver articles worn or carried about the person, and of rendering the exhalations from the body very offensive. When applied externally, its effects are scarcely observable if the skin be whole, but if it be broken, the sulphur acts as a topical irritant. Internally, sulphur is useful as a laxative in hæmorrhoids, fissure, stricture, prolapsus, and other diseases of the rectum; it has been recommended in phthisis, chronic bronchitis, asthma, hooping-cough, angina pectoris, and other chest affections; in acute and chronic rheumatism, &c. But its chief use is in many skin diseases, and especially in scabies. In these cases it may be both given internally and applied externally; but in the cure of itch its local application is all that is required. In combination with lime, in the form of a solution of sulphide or sulphuret of calcium (obtained as in the first stage of the preparation of precipitated sulphur) it is said to cure the disease by a single application, the patient being previously and subsequently well washed in a warm bath. Sulphur fumigations are used in similar cases, also in lead poisoning, &c. For this purpose, the patient is placed in a suitable apparatus, somewhat in the form of a vapour bath, great care being taken to protect the respiratory organs from the fumes, by closing the apparatus round the neck. A deposit of sulphide of lead forms, which is carefully brushed off the skin, and by repeating this process a cure is ultimately effected. Factitious and natural sulphur baths are used for similar purposes.

Sulphurous Acid (SO_2). *Synonyms:* Acidum Sulphurosum—Acide Sulphureux—Sulphurous Acid gas dissolved in water.

Preparation.—*Take of sulphuric acid 4 fluid ounces; wood charcoal, broken into small pieces, 1 ounce; water, 2 fluid ounces; distilled water, 20 fluid ounces. Put the charcoal and the sulphuric acid into a glass flask, connected by a glass tube, with a wash bottle containing the two ounces of water, whence a second tube leads into a pint bottle containing the distilled water, to the bottom of which the gas-delivery tube should pass. Apply heat to the flask until gas is evolved, which is to be conducted through the water in the wash bottle, and then into the distilled water, the latter being kept cold, and the process being continued until the bubbles of gas pass through the solution undiminished in size. The product should be kept in a stoppered bottle, in a cool place.*

Rationale.—The sulphuric acid yields an equivalent of oxygen to the carbon to form carbonic oxide, and thus becomes sulphurous acid ($H_2SO_4 + C = CO + H_2O + CO_2$). Both these gases pass over together, and with them a trifling quantity of carbonic acid, but the carbonic oxide being almost insoluble in water, is driven off. The intervening wash bottle is to catch any sulphuric acid that may pass over. When the

bubbles pass through the solution unchanged, it shows that the water in the larger bottle is fully charged, but it will not absorb a sufficient quantity if the water be not kept cool; and obviously, if the bottle be not subsequently well stoppered, the gas would escape, and, moreover, by absorbing oxygen from the atmosphere, would be partially converted into sulphuric acid.

CHARACTERS.—*A colourless liquid with a pungent sulphurous odour. Specific gravity* 1·04. *It gives no precipitate, or but a very slight one, with chloride of barium,*[1] *but a copious one if solution of chlorine be also added.*[2]

[1] Wherein it differs from sulphuric acid, showing that it contains none of it. [2] The effect being to produce sulphuric and hydrochloric acids by the decomposition of water ($SO_2 + 2H_2O + 2Cl = 2HCl + H_2SO_4$) the latter giving the precipitate with chloride of barium. The gas itself is colourless, transparent, irrespirable, producing the choking effects of burning sulphur, whereby it is generated, possesses bleaching properties, and has an acid reaction.

PURITY TESTS.—34·7 *grains by weight of it mixed with an ounce of distilled water and a little mucilage of starch do not acquire a permanent blue colour with the volumetric solution of iodine until* 1000 *grain measures of the latter have been added.*[1] *When evaporated it leaves no residue.*[2]

[1] If the gas be present in proper quantity it will continue to prevent the formation of blue iodide of starch until 1000 grain measures have been added, by converting the iodine into hydriodic acid, which does not give a blue colour with starch. ($SO_2 + 2H_2O + I_2 = 2HI + H_2SO_4$); 1000 grain measures of the volumetric solution of iodine will exhast 3·2 grains of sulphurous acid, equivalent to 9.2 per cent. [2] Absence of fixed impurity.

Dose.—Internally, min. v, x, xx to a fluid drachm, or more, sufficiently diluted with water. Externally, as a lotion of the strength of one to eight of water; or stronger, as one part to two of water or of glycerine.

Sulphurous acid acts as an irritant, disinfectant, antiseptic, and as a destroyer of certain parasitic vegetable growths which infest the human body. The attention of the profession was, during the years 1866-67, drawn specially to the virtues of this medicine by various observers, but chiefly by the writings of Dr Dewar, of Kirkcaldy, who, by noticing its beneficial effects on his groom (a sufferer from phthisis), while engaged in fumigating cattle with sulphurous acid, was led to a more extended employment of it. He recommends it as most beneficial when inhaled in phthisis, bronchitis, catarrh, emphysæma, &c., or when applied as spray in scarlet fever, diphtheria, putrid sore throat, &c., and as a lotion, and as spray, in healing sores, weak and specific ulcers, lupus, chilblains, sore nipples, hæmorrhoids, &c. Though we fear its virtues have been overrated by some of its advocates, yet there is reason to believe that sulphurous acid is a good stimulant and antiseptic application to putrid sores generally, as, since by its deoxidizing properties, it defends them

from the influence of the oxygen of the air; while it tends, at the same time, to promote healthy action; also, that it is an expectorant of considerable value. In the latter case it does not always succeed, but if it does, it acts invariably, after a little, as a sedative and calmative. Internally, it has been recommended in the treatment of yellow fever, and lately was found very beneficial in the hands of Mr Fiddes, during an outbreak of that disease in Jamaica. It is also administered in those cases of dyspepsia and vomiting in which the ejected matters contain *Sarcinæ ventriculi*, with the view of destroying the vegetable growth in the stomach. Externally, it is used in parasitic skin diseases. Lint soaked in the lotion, and covered with oil silk, may be applied, or the strong solution, with an equal part of glycerine, may be painted upon the part. The fumes of burning sulphur, in combination with steam, in the form of a vapour bath, are employed for similar purposes, care being taken to protect the respiratory organs from their suffocating properties. Internally, sulphurous acid may be administered in doses of min. x, xxx, dissolved in water. Externally, it may be applied in lotion of from one of the acid to from two to eight parts of water or glycerine, according to the condition of the sore; or it may be applied in the form of spray, by means of the spray producer, and, in that case, the solution of the Pharmacopœia is suitable undiluted. For inhalation, it is best to sprinkle a little flowers of sulphur over a clear coal in an iron shovel in the sick room, and inhale the sulphurous acid fumes as they are formed.

SULPHITE OF SODA ($NaO,SO_2 + 7HO$, or $Na_2SO_37H_2O$)—Sodæ Sulphis. This may be prepared by saturating carbonate of soda with pure sulphurous acid gas, or by neutralising bisulphite of soda with carbonate of soda. It crystallises in white prisms, which are soluble in four parts of water at 60° *Bisulphite of Soda* is obtained by supersaturating a solution of carbonate of soda with a pure sulphurous acid gas. It crystallises in four-sided rectangular prisms, has an acid reaction, and a sulphurous taste and odour. The sulphites of soda, in doses of ten or twenty grains to a drachm, are given internally in cases of *Sarcinæ ventriculi*, SO_2 being evolved when the salt comes into contact with the acids of the stomach. In large doses, as a drachm to half an ounce, the sulphites act as purgatives. Externally, as lotions to parasitic skin-diseases.

Hyposulphite of Soda ($NaOS_2O_2 + 5HO$ or $Na_2S_2H_2O_4,4H_2O$) —Sodæ Hyposulphis—Natrium Oxidatum Subsulphurosum. This salt may be prepared by digesting a solution of the sulphite with sulphur ($Na_2SO_3 + S + H_2O = Na_2S_2H_2O_4$); or by passing sulphurous acid gas through a solution of sulphide of sodium ($2Na_2S + 3SO_2 + 2H_2O = 2Na_2S_2H_2O_4 + S$), or by other processes. It occurs in prismatic crystals, which have a bitter, saline, disagreeable taste, are inodorous, readily soluble in water, but not in alcohol, are decomposed by heat, and, on

the addition of acids, are resolved into SO_2, which is evolved, and sulphur, which is deposited. When pure, 24·8 grains decolorise 1000 grain measures of the volumetric solution of iodine.

The experiments of Professor Polli on dead and living organisms led him to the conclusion that sulphurous acid, the sulphites and hyposulphites of lime, soda, &c., are possessed of valuable antiseptic properties, which are capable of being utilized in medicine, to prevent or modify the progress of diseases believed to be due to the action of morbid ferments in the blood. For this reason, he recommends the internal use of sulphites and hyposulphites in pyæmia, typhoid fever, glanders, &c. Now, though we may doubt the soundness of the pathological doctrine on which Polli proceeds, yet we have reason to believe that the sulphites exert, in many cases, beneficial effects in disease by their antiseptic action upon putrescent secretions, as in the case of alkaline urine from diseased bladder, and in diarrhœa with very offensive stools, &c. The capability of sulphurous acid, of the sulphites, and of the hyposulphites in the preservation of prepared meat, and of vegetable juices from fermentative and putrefactive changes, is truly marvellous, and well merits much greater attention than it has yet received. So small a quantity of the acid is needed, that it could scarcely interfere, in the least degree, with the taste or use of the substances kept by it. These properties might be extensively utilised by allowing a very small quantity of sulphurous acid or of a sulphite to be added to officinal vegetable infusions, &c., which are so liable to decay, and, indeed, frequently get positively hurtful before an ordinary prescription is used by the patient. In small doses (ten or twenty grains to a drachm) hyposulphite of soda acts as an alterative, sudorific, and resolvent; in large doses (one or more drachms) it acts, like sulphate of soda, as a cathartic. In alterative doses it is given in *Sarcinæ ventriculi*, SO_2 being evolved when the salt comes into contact with the acids of the stomach. It is also used in a variety of diseases as a substitute for the natural sulphur waters; in cutaneous, scrofulous, hepatic, syphilitic, gouty, and rheumatic affections. Externally, in the form of lotion or as a bath (℥½–i to each gallon of water), in parasitic skin diseases. Sometimes a little dilute sulphuric acid is added to the lotions and baths, in order to set the sulphurous acid at liberty: care must then be taken to protect the air-passages from the suffocating effects of the SO_2.

Sulphurated Potash. *Synonyms:* Potassa Sulphurata — Potassii Sulphuretum—Kali Sulphuratum—Hepar Sulphuris—Liver of Sulphur.

PREPARATION.—*Take of carbonate of potash, in powder,* 10 *ounces; sublimed sulphur,* 5 *ounces. Mix the carbonate of potash and the sulphur in a warm mortar, and, having introduced them into a Cornish or Hessian crucible, let this be heated, first gradually, until effervescence has ceased, and finally to dull redness, so as to produce perfect fusion. Let the liquid contents of the crucible be then poured out on a clean flagstone, and covered quickly with an inverted porcelain basin, so as to exclude the air as completely as possible while solidification is taking place. The solid product thus obtained should, when cold, be broken into fragments, and immediately enclosed in a green glass bottle, furnished with an air-tight stopper.*

Rationale.—$4K_2CO_3 + 10S = 3K_2S_3 + K_2SO_4 + 4CO_2$. The carbonic acid passing off, leaves three of tersulphuret (or tersulphide) of potassium in combination with one of sulphate of potash.

CHARACTERS.—*Solid greenish fragments, liver-brown when recently broken, alkaline, and acrid to the taste, readily forming with water a yellow solution, which has the odour of sulphuretted hydrogen, and evolves it freely when excess of hydrochloric acid is dropped into it, sulphur being at the same time deposited.*[1] *The acid fluid, when boiled and filtered, is precipitated yellow by perchloride of platinum,*[2] *and white by chloride of barium.*[3]

[1] ($3K_2S_3 + 6HCl = 6KCl + 3H_2S + 6S$). [2] Producing the *potassio-perchloride of platinum,* $2KCl,PtCl_4$: this precipitate is formed immediately in concentrated solutions, but only slowly in dilute solutions: it proves it to be a salt of potash. [3] Producing *sulphate of barium,* which is insoluble in hydrochloric acid, and thus proving the presence of sulphuric acid.

The exact constitution of this compound is somewhat uncertain. Berzelius gives the formula $3K_2S_3 + K_2SO_4$, as above. Phillips gives the formula $2K_2S_5 + K_2S_2H_2O_4$; namely, two of pentasulphuret (or pentasulphide) of potassium with one of hyposulphite of potash, which might be produced in this way, $3K_2CO_3 + 12S + H_2O = 2K_2S_5 + K_2S_2H_2O_4 + 3CO_2$. When exposed to the air it deliquesces, and by decomposing water precipitates sulphur and evolves sulphuretted hydrogen (or sulphide of hydrogen) thus: $K_2S_3 + H_2O = K_2O + S_2 + H_2S$; at the same time, by the absorption of oxygen, it passes through the states of hyposulphite and sulphite, and ultimately becomes entirely sulphate of potash, when it is white, inodorous, and destitute of its original medicinal properties.

PURITY TEST.—*About three-fourths of its weight are dissolved by rectified spirit.*

Rectified spirit dissolves the tersulphuret of potassium, but not the sulphate of potash; hence, if less than three-fourths be dissolved, it indicates the presence of an excess of sulphate.

Dose.—Two to ten grains dissolved in water and sweetened; or in pills; externally, one or two drachms to a pint of water as a lotion; as an ointment, a drachm to an ounce of lard; as a bath, four ounces to thirty gallons of water.

Antidotes.—Liquor sodæ chloratæ, or liquor calcis chloratæ, sufficiently diluted; emetics; demulcents.

UNGUENTUM POTASSÆ SULPHURATÆ, Ointment of Sulphuretted Potash.

PREPARATION.—*Take of sulphurated potash,* 30 *grains; prepared lard,*

1 *ounce. Triturate the sulphurated potash in a porcelain mortar, and gradually add the lard, rubbing them together until the ointment is perfectly smooth and free from grittiness.*

Should only be used when recently prepared.

Sulphurated potash appears to combine the properties of an alkali with those peculiar to sulphur, when administered internally. When applied externally, it acts as an irritant. Its effects as an internal remedy are modified by the contents of the stomach; if they be acid, decomposition takes place, sulphuretted hydrogen is evolved, and a mild neutral salt is formed. Usually it acts as a gentle stimulant, exciting the circulation, augmenting the heat of the surface, and giving an impulse to the secreting organs, especially the liver, the skin, and mucous membranes. It is stimulant, diaphoretic, and expectorant; but it is comparatively rarely given internally in this country. In large doses it acts as an acro-narcotic poison, and has on several occasions proved fatal: as such, it produces severe pain in the *primæ viæ*, vomiting, great depression, and convulsions. In smaller quantities it is apt to cause considerable gastric irritation, followed by nausea, vomiting, and hypercatharsis.

It has been employed internally, for the sake of its general stimulating properties, in certain forms of dyspepsia, in which the mucous follicles are affected, in the latter stage of hooping-cough, in chronic rheumatism, in chronic bronchitis, in croup, in catarrhus vesicæ, and in obstinate chronic cutaneous diseases. Externally, in the form of lotion, bath, or ointment, it is applied in a variety of chronic skin diseases, in some of which it operates as an irritant, in others by its alkalinity, and in a third class, of parasitic origin, by the action of the sulphur in destroying the organisms. The solution has also been used, by injection into the mucous orifices, for the cure of mucopurulent discharges. The bath is used also for the cure of lead-poisoning; they are frequently repeated, so long as the skin continues to be blackened by them. Metallic vessels should be avoided in preparing the bath, those of wood or earthenware being preferable; and care must be taken to protect the patient from the effects of a too free evolution of sulphuretted hydrogen.

CARBON ($C=6$ or 12)—*Carbo, Coal. Synonyms*: Carbo—Carbonium—Charbon—Kohlenstoff.

Carbon is widely distributed throughout nature; it enters largely into the animal and vegetable kingdoms, and is an important constituent of the mineral kingdom. It is found in various states, as in the crystalline condition of the diamond, which is its purest form, in plumbago or gra-

phite, in anthracite, in coke, which is the carbon of coal, and in charcoal, obtained either from animal or vegetable tissues ; and all these substances are regarded as merely allotropic forms of the one elementary substance, *Carbon.*

In the form of graphite, carbon has been long used in medicine, both internally and externally ; but it is now used only in the form of charcoal, of which there are two officinal varieties, *Carbo Ligni* and *Carbo Animalis.*

Carbo Ligni—Wood Charcoal—Carbo e Vegetabilibus—Vegetable Charcoal—Wood charred by exposure to a red heat without access of air.

Preparation.—It is prepared by the combustion of billets of wood, chiefly oak, beech, hazel, or poplar, in covered heaps or in closed vessels, in such a manner as to prevent as much as possible the access of air. The O, H, and N of the vegetable structure are almost entirely driven off during the process, but the C in greater part remains. Wood yields from twenty to twenty-five per cent. of charcoal, consisting of carbon with about two per cent. of vegetable ashes, chiefly carbonate of potash and lime.

CHARACTERS.—*In black, brittle, porous masses, without taste or smell, very light, and retaining the shape and texture of the wood from which it was obtained.*

PURITY TEST.—*When burned at a high temperature with free access of air, it leaves not more than two per cent. of ash.*

CATAPLASMA CARBONIS—*Charcoal Poultice. Take of wood charcoal, in powder,* ½ *ounce; crumb of bread,* 2 *ounces; linseed meal,* 1½ *ounce; boiling water,* 10 *fluid ounces. Macerate the bread in the water for ten minutes near the fire, then mix and add the linseed meal gradually, stirring the ingredients, that a soft poultice may be formed. Mix with this half the charcoal, and sprinkle the remainder on the surface of the poultice.*

Dose of Charcoal.—From a few grains to a table-spoonful: in doses of ten or twenty grains frequently repeated, as in dysentery; or in table-spoonful doses before and after meals, as in painful dyspepsia.

Charcoal acts the part of an antacid, antiseptic, disinfectant, deodoriser, &c. It is administered internally for the relief which it affords in acidity of the *primæ viæ*, and in many disorders dependent upon acrid matters in the alimentary canal ; and both internally and externally for the removal of fetid odours. In dyspepsia, gastrodynia, pyrosis, cardialgia, diarrhœa, dysentery, flatulence with constipation, or with hysteria, as a tooth powder, &c., the object in all such cases being either to give relief from acidity, flatulence, or acrid discharges, or to overcome the offensive odour of the breath or of the alvine evacuations. Externally, in the form of poultice, it is applied to cleanse and deodorise offensive ulcers, gangrene, phagedæna, &c. It is used also in the form of a respirator, as a protection against poisonous gases, also as a filter for the purification of water. For medicinal purposes it should be

either recently prepared, or be exposed to a high temperature to purify it. It may be given internally, in the form of biscuits or lozenges.

Carbo-Animalis Purificatus—Purified Animal Charcoal—Bone Black deprived of its earthly salts. Bone black, ivory black, or impure animal charcoal, is the powdered residue of ox and sheep bones, which have been exposed to a red heat, without the access of air. In this state it consists chiefly of phosphate and carbonate of lime, carburet and sulphuret of iron, and sulphuret of calcium, with from ten to twenty per cent. of charcoal, and to remove the salts in order to render it useful for pharmaceutical purposes is the object of the following purifying process:—

PREPARATION.—*Take of bone black in powder,* 16 *ounces; hydrochloric acid,* 10 *fluid ounces; distilled water, a sufficiency. Mix the hydrochloric acid with a pint of the water, and add the bone black, stirring occasionally. Digest at a moderate heat for two days, agitating from time to time: collect the undissolved charcoal on a calico filter, and wash with distilled water till what passes through gives scarcely any precipitate with nitrate of silver. Dry the charcoal, and then heat it to redness in a closely-covered crucible.*

Rationale.—The phosphate of lime is converted into the soluble superphosphate; the carbonate of lime is converted into the soluble chloride of calcium and carbonic acid which escapes; the carburet and sulphuret of iron and calcium are converted into soluble chlorides, with the evolution of sulphuretted hydrogen; and thus all the salts being rendered soluble, are readily removed by washing, and the purified charcoal remains.

CHARACTERS.—*A black pulverulent substance, inodorous and almost tasteless. Tincture of litmus diluted with twenty times its bulk of water, agitated with it, and thrown upon a filter, passes through colourless.*

PURITY TEST.—*When burned at a high temperature with a little red oxide of mercury, and free access of air, it leaves only a slight residue.*

Dose.—From a few grains, frequently repeated, to a table-spoonful or more, occasionally, before or after meals in painful dyspepsia; or as an antidote, in doses of an ounce and upwards, according to the quantity of poison taken.

Animal charcoal is chiefly used as a decolorising agent in pharmacy and the arts, and but little as a medicine. But it may be employed in the same cases as wood charcoal. It has been recommended as an antidote in poisoning by certain alkaloids, as morphia, strychnia, aconitia; but it is exceedingly doubtful if it ever does more in such cases than simply entangle, and thus delay, the absorption of the poison to a slight extent. Externally, to destroy the fetor of ulcers, &c.

CARBONII BISULPHURETUM (CS_2)—Bisulphuret or bisulphide of carbon, or sulpho-carbonic acid, occurs as a mobile, volatile, trans-

parent, and colourless fluid; insoluble in water, but soluble in alcohol and ether. It has a pungent taste, a peculiar fetid odour, resembling decaying vegetable matter, and a specific gravity of 1·272. It is highly poisonous; it has been used internally as a stimulant and emmenagogue, in doses of two or four drops, in mucilage; externally, as a stimulating embrocation, combined with oil; and as an anæsthetic by inhalation of its vapour.

PHOSPHORUS (P=32. Φως, *light*, and φέρω, *I bear*).—Phosphore—Phosphor—Non-metallic element obtained from bones.

Phosphorus is obtained first by the action of sulphuric acid upon calcined bones, and subsequently by distillation with charcoal, &c. The phosphate of lime of the bones is converted by the sulphuric acid into superphosphate and sulphate of lime; and again, the acid phosphate or superphosphate, when heated with charcoal, is changed into phosphate, carbonic oxide, water, and phosphorus.

Characters and Tests. — *A semi-transparent, colourless, wax-like solid, which emits white vapours when exposed to the air. Specific gravity* 1·77. *It is soft and flexible at common temperatures, melts at* 110°, *ignites in the air at a temperature a little above its melting point, burning with a luminous flame, and producing dense white fumes. Insoluble in water, but soluble in ether and in boiling oil of turpentine.*

Antidotes.—There is no known antidote; emetics; hydrate of magnesia, lime water, charcoal; demulcent, mucilaginous, or albuminous drinks; gentle laxatives, and probably oils, might be of greater service, by protecting the intestinal mucous membrane, than is usually supposed. Oil of turpentine has been lately recommended in Paris as an antidote for it,—the explanation being that it prevents the oxidation of the phosphorus in the body. It is stated to have been successful in several cases.

Doses.—From one-fortieth of a grain upwards; never in the solid form, however minutely divided; but in solution either in ether or oil, the latter being the safer solvent, since the ethereal solution by evaporation becomes imperceptibly stronger.

Phosphorus in over-doses acts as an irritant poison, causing inflammation of the stomach and bowels, and it is not an unfrequent cause of death, both designedly and accidentally. Many children have died after playing with, and licking, the ends of lucifer matches; others have eaten it with fatal results, when strewed as a poison for vermin, and it has been administered with the criminal intention of producing death. The poisonous effects of phosphorous do not follow immediately after it is taken, generally not until several hours have elapsed, and occasionally at the expiration of one or two days. The symptoms, which when once manifested run a rapid course, are those of an irritant poison: from the mouth to the stomach there is an acrid burning feeling, with increasing pain in the latter organ; there is intense thirst, nausea, vomiting, and

purging; the abdomen becomes tympanitic; there is extreme depression, with a small, fluttering pulse, cold clammy skin, and ultimately fatal collapse, occasionally preceded by convulsions. The breath, vomited matters, and dejections of the patient have the odour of garlic, they emit white vapours, and in the dark are sometimes luminous. Death usually follows, after intense suffering, in a few days; the extreme periods are said to be four hours in the most rapid, and seventeen days in the most protracted case. One and a half grains of phosphorus have caused death, and possibly less might prove fatal; but on the other hand, many grains have been taken, and frequently repeated, with impunity.

Workmen who are exposed to the fumes of phosphorus, as in lucifer-match making, are more or less affected by it, caries of the teeth proceeding to necrosis of the jaw being the usual course of the poisonous action in this way. The disease originates in an intense ostitis, which is most probably set up by the phosphoric acid dissolved in the saliva penetrating into the jaw through the cavities of the diseased teeth.

Medicinally, phosphorus acts as a general stimulant of very great energy, and requiring extreme caution in its administration to avoid accidents. It acts upon the nervous, circulatory, and muscular systems, causing increase of mental activity, greater force and frequency of the pulse, elevation of the temperature of the skin, general excitation and hilarity, and exaltation of the sexual appetite. It acts, moreover, as a sudorific and diuretic, &c. Externally, it is irritant, and has been used as a stimulating embrocation, and as a substitute for the moxa. Dissolved in oil, it has lately been recommended as a mode of curing cataract without operation. Phosphorus is not much used in its elementary form at present. It has been recommended in diseases of an adynamic type, in typhoid and typhus fever, in paralysis, melancholia, amaurosis, in convalescence from illnesses when there is great debility present, in phthisis, in cholera, and to bring out again retrocedent skin eruptions. But it is chiefly as an aphrodisiac in cases of impotency that phosphorus has been vaunted. It must be confessed, however, that the results have only been of a temporary character. Dr Delpech, of the Necker Hospital, has lately recommeded it as a cure for the anaphrodisia and nervous cachexia peculiar to workers in vulcanised india-rubber, which he believes due to the bisulphide of carbon evolved during the mechanical processes exercising a solvent action on the phosphoretted brain-fat of the workmen.

Acidum Phosphoricum Dilutum—Diluted Phosphoric Acid—Terhydrated (or tribasic) Phosphoric Acid—Phosphoric Acid ($3HO,PO_5$, or H_3PO_4) dissolved in water.

Preparation.—*Take of phosphorus* 413 *grains; nitric acid,* 6 *fluid ounces; distilled water, a sufficiency. Put the nitric acid diluted with* 8 *ounces of distilled water into a tubulated retort connected with a Liebig's condenser, and, having added the phosphorus, apply a gentle heat so as slowly to distil five fluid ounces of liquid.* [1] *Return this to the retort, and continue the distillation, occasionally returning the distillate, until the phosphorus has entirely disappeared.* [2] *Transfer the contents of the retort to a porcelain dish of hard well-enamelled ware, and evaporate the liquid, until it is reduced to four fluid ounces, then, transferring it to a platinum vessel, continue the evaporation until it is reduced to about two fluid ounces, and orange-coloured vapours are no longer formed. Mix it now with distilled water, until, when cold, it measures one pint.*

Rationale.—The process may be imperfectly represented by the following formula:—$6P + 5N_2O_5 = 5N_2O_2 + 3P_2O_5$; each equivalent of phosphoric anhydride thus formed taking three equivalents of water to constitute the tribasic acid. The reaction is, however, practically, much more complex. [1] A part of the nitric acid distils over before the phosphorus is sufficiently melted to be affected by it, hence it is necessary to return this to the retort. [2] The retort now contains phosphorous acid, phosphoric acid, and nitric acid; the next part of the process is to convert the phosphorous into phosphoric acid, which is effected by the nitric acid giving off a part of its oxygen, the remainder being expelled in the form of the orange vapour of nitric oxide.

Characters.—*A colourless liquid with a sour taste, and strongly acid reaction. With ammonio-nitrate of silver it gives a canary-yellow precipitate*[1] *soluble in ammonia, and in diluted nitric acid. Evaporated, it leaves a residue, which melts at a low red heat, and upon cooling exhibits a glassy appearance.*[2]

[1] Tribasic phosphate of silver, Ag_3PO_4. [2] Glacial phosphoric acid. Phosphoric acid is recognised under three forms, varying according to the amount of basic water; they are known respectively as monobasic, bibasic, and tribasic; as monohydrated, dishydrated, and trishydrated; as protohydrated, bihydrated, and terhydrated; or as metaphosphoric, pyrophosphoric, and common phosphoric acids; the respective formulæ are HPO_3, $H_4P_2O_7$, and H_3PO_4. The officinal acid contains ten per cent. of the tribasic acid.

Purity Tests.—*Specific gravity* 1·08. *It is not precipitated by sulphuretted hydrogen,*[1] *chloride of barium,*[2] *nitrate of silver acidulated with nitric acid,*[3] *or by the solution of albumen.*[4] *When mixed with an equal volume of pure sulphuric acid, and then introduced into solution of sulphate of iron, it does not communicate to it a dark colour.*[5] *Mixed with an equal volume of solution of perchloride of mercury and heated, no precipitate is formed.*[6] 355 *grains by weight of it poured upon* 180 *grains of oxide of lead, in fine powder, leave by evaporation a residue, principally phosphate of lead, which, after it has been heated to dull redness, weighs* 215·5 *grains.*[6] *Six fluid drachms therefore correspond to* 35·5 *grains of anhydrous phosphoric acid, half an equivalent of PO_5 or a quarter of an equivalent of P_2O_5*[7].

[1] Absence of metallic impurities. [2] Absence of sulphuric acid. [3] Absence of hydrochloric acid. [4] Distinguishing it from metaphosphoric acid which coagulates albumen. [5] Absence of nitric acid. [6] Absence of hydriodic acid. [7] Anhydrous phosphate of lead. Since 355 grains of the dilute acid contain 35·5 grains of anhydrous phosphoric acid, it follows that the officinal strength is exactly 10 per cent.

Dose.—Ten to twenty or thirty minims and upwards, sufficiently diluted with water. Parrish's *Compound Syrup of the Phosphates,* and other syrups of the phosphates, to be mentioned hereafter, are much used.

Antidotes.—The indications are simply to neutralize the acid by means of the alkalies or their carbonates, and to soothe by demulcents and antiphlogistics.

In full doses phosphoric acid acts as a stimulant, and as an irritant in poisonous doses, but, except by experiment upon animals, little is known of its poisonous effects. In medicinal doses it acts as a tonic, refrigerant, aphrodisiac, antiscorbutic, and as a resolvent of phosphatic deposits. Its effects resemble those of dilute sulphuric acid, but it is not so astringent. It has been recommended as a tonic in cases of general debility, atonic dyspepsia, &c., similar to those for which the other mineral acids are employed; in typhus and typhoid fevers; in colliquative sweating and diarrhœa; in scrofulous affections; in rachitis; in the phosphatic diathesis, and for the removal of phosphatic deposits, urinary and osseous; in scurvy; in impotency from nervous debility; as a drink to allay thirst in diabetes, &c.

Hypophosphorous Acid ($HO,PO,2HO$, or HPH_2O_2). This acid, which used to be considered an acid of phosphorus, with a still lower amount of oxygen than the phosphorous acid, has the formula, HPH_2O_2. Its anhydride has never been obtained. It unites with bases to form hypophosphites. It is not employed medicinally, but enters into the constitution of the

Hypophosphites. — CALCIS HYPOPHOSPHIS ($CaO,PO,2HO$, or $Ca\,2PH_2O_2$)—*Hypophosphite of Lime*—may be prepared by boiling four parts of milk of lime with one part of phosphorus until phosphoretted hydrogen ceases to be given off. It is carefully filtered, and excess of lime is precipitated by a stream of carbonic acid gas. When the solution of hypophosphite of lime is carefully evaporated, it yields white, flattened, prismatic crystals, which have a pearly lustre, are soluble in six parts of either cold or boiling water, insoluble in absolute and scarcely soluble in diluted alcohol. POTASSÆ HYPOPHOSPHIS ($KO,PO,2HO$, or KPH_2O_2)—*Hypophosphite of Potash*—may be prepared by acting upon hypophosphite of lime with carbonate of potash, which mutually decompose each other, hypophosphite of potash being left in solution and carbonate of lime precipitated. The crystals are white and opaque; they are soluble both in water and in alcohol, and readily deliquesce on exposure to the atmosphere. SODÆ HYPOPHOSPHIS ($NaO,PO,2HO$, or $NaPH_2O_2$)—*Hypophosphite of Soda*—may be prepared by acting upon hypophosphite

of lime with carbonate of soda, which mutually decompose each other, hypophosphite of soda being left in solution and carbonate of lime precipitated. The crystals have a pearly lustre, are of the rectangular tabular form, are soluble both in alcohol and in water, and are slightly deliquescent, but not so much so as the corresponding potash crystals; it is apt to explode during the evaporation of the solution. AMMONIÆ HYPOPHOSPHIS ($NH_4O,PO,2HO$, or $NH_4PH_2O_2$)—*Hypophosphite of Ammonia*—may be prepared by acting upon hypophosphite of lime with carbonate of ammonia. Like the corresponding potash salt, it is very deliquescent in air, and is readily soluble both in alcohol and water. FERRI HYPOPHOSPHITES: Of these there are two, namely *ferric* hypophosphite and *ferrous* hypophosphite, the former being a hypophosphite of the *peroxide*, the latter of the *protoxide* of iron. Besides the foregoing, there are also hypophosphites of manganese, of quinine, &c.

Doses of the Hypophosphites.—From two to five grains thrice daily; they may be given in combination with a vegetable tonic, or in the form of syrup. They may be given either separately, as in the simple syrups, or in combination, as in the compound syrups, which may contain several of the hypophosphites. The dose of the syrups is usually about a tea-spoonful.

The hypophosphites are supposed to exercise all the beneficial effects of phosphorus without producing any of the untoward consequences of that elementary substance. They are called stimulants, tonics, alteratives, nervine stimulants, hæmatogens, &c. They were introduced by Dr Churchill, and have been used chiefly in phthisis in all its stages, in general debility resulting from exhaustive discharges, in all cases in which the phosphates are deficient, in chorea, epilepsy, leucocythemia, anæmia, &c.

CLASS II.—CERTAIN ACIDS WHICH MAY BE CONVENIENTLY CONSIDERED TOGETHER.

GROUP I. SULPHURIC, HYDROCHLORIC, NITRIC, NITRO-HYDROCHLORIC, CHROMIC, CARBONIC, HYDROSULPHURIC.

ACIDUM SULPHURICUM (HO,SO_3, or H_2SO_4). *Synonyms:* Sulphuric Acid—Oil of Vitriol—Acide Sulphurique—Schwefelsäure—Pure Sulphuric Acid. An acid produced by the combustion of sulphur and the oxidation of the resulting sulphurous acid by nitrous fumes.

Sulphuric acid occurs as a a natural product, but only to a limited extent; for commercial purposes it is prepared by admitting simultaneously into suitable leaden chambers sulphurous acid gas, nitric acid vapour, and steam. The sulphurous acid gets oxidized by the oxygen of the nitric acid, and the steam uniting with the anhydrous acid resulting, converts it into the ordinary acid H_2SO_4. Thus $3SO_2 + N_2O_5 = 3SO_3 + N_2O_2$. Then $N_2O_2 + 3SO_3 + 3H_2O = 3H_2SO_4 + N_2O_2$. The N_2O_2 thus set free attracts oxygen from the air, and becomes N_2O_4, after which it converts a fresh quantity of SO_2 into SO_3. Thus $N_2O_4 + 2SO_2 = 2SO_3 + N_2O_2$, and $2SO_3 + N_2O_2 + 2H_2O = 2H_2SO_4 + N_2O_2$, and so on.

CHARACTERS.—*A colourless liquid of oily appearance, intensely acid and corrosive. It evolves much heat on the addition of water, and when thus diluted, gives a copious precipitate with chloride of barium.*

It readily abstracts organic impurities, both during its preparation and on subsequent exposure, from the atmosphere, and is, therefore, seldom quite colourless, being usually of a pale straw or somewhat darker colour. It eagerly absorbs moisture from the atmosphere, and thereby rapidly increases in bulk ; in consequence of this property of absorbing moisture, it chars most organic substances. The proportions of acid and water which by their union produce the greatest heat are, according to Dr Ure, 73 of the former and 27 of the latter. The white precipitate with chloride of barium is insoluble in water, acids, and alkalies, and is a characteristic test for sulphuric acid and soluble sulphates.

PURITY TESTS.—*Specific gravity* 1·843.[1] 50·6 *grains by weight mixed with an ounce of distilled water require for neutralisation* 1000 *grain measures of the volumetric solution of soda.*[2] *Evaporated in a platinum dish it leaves little or no residue.*[3] *When a solution of sulphate of iron is carefully poured over its surface there is no purple colour developed where the two liquids unite.*[4] *Diluted with six times its volume of distilled water it gives no precipitate with sulphuretted hydrogen.*[5]

[1] The specific gravity is reduced by the addition or gradual absorption of water. [2] 50·6 grains of the officinal acid contain half an equivalent (49 grains of H_2SO_4 and 40 grains of SO_3), which is equal to a strength of 96·8 and 79 per cent. of these acids respectively. [3] Absence of fixed impurities. [4] Absence of the oxides of nitrogen, especially nitrous acid. [5] Absence of arsenic. Sulphate of lead would be detected by the acid becoming turbid when diluted with water.

ACIDUM SULPHURICUM AROMATICUM—*Aromatic Sulphuric Acid—Elixir of Vitriol.—Take of sulphuric acid,* 3 *fluid ounces, or* 2419 *grains by weight; rectified spirit,* 2 *pints; cinnamon bark, in coarse powder,* 2 *ounces; ginger, in coarse powder,* 1¼ *ounce. Mix the sulphuric acid gradually with the spirit, add the cinnamon and ginger, macerate for seven days, agitating frequently. Then filter.*

TESTS.—*Specific gravity* 0·927. 304·2 *grains by weight (six fluid drachms) require for neutralisation* 830 *grain measures of the volumetric solution of soda, corresponding to* 10·91 *per cent. of anhydrous sulphuric acid. Six fluid drachms, therefore, correspond to* 33·2 *grains of anhydrous acid.*

ACIDUM SULPHURICUM DILUTUM—*Dilute Sulphuric Acid —Elixir of Vitriol.— Take of sulphuric acid* 7 *fluid ounces; distilled water, a sufficiency Dilute the acid with* 77 *fluid ounces of the water, and when the mixture has cooled to* 60° *add more water, so that it shall measure* 83½ *fluid ounces. Or as follows:—Take of sulphuric acid* 1350 *grains, distilled water a sufficiency. Weigh the acid in a glass flask, the capacity of which to a mark on the neck is one pint. Then gradually add distilled water until the mixture, after it has been shaken and cooled to* 60°, *measures a pint.*

TESTS.—*Specific gravity* 1·094. 359 *grains by weight (six fluid drachms of it) require for neutralisation* 1000 *grain measures of the volumetric solution of soda, corresponding to* 10·14 *per cent. of anhydrous sulphuric acid. Six fluid drachms, therefore, correspond to* 40 *grains of the anhydrous acid (one equivalent of SO_3, or half an equivalent of* $\mathbf{SO_3}$).

Dose.—The strong acid is used only externally; of the aromatic and diluted acids, five or ten to twenty or thirty minims, sufficiently diluted, the former being somewhat weaker than the latter.

Antidotes.—Alkaline bicarbonates and carbonates, though the latter, being somewhat corrosive, are less eligible; potash and soda salts are preferable to chalk and magnesia, but these may be used when the others are not at hand; diluents; a bland oil; emulsion of oil and magnesia; avoid the use of the stomach pump, unless it be essential from inability to swallow, as it is very apt to injure the parts. Subsequently, stimulants, antiphlogistic treatment, tracheotomy, &c., as circumstances require. Externally, leeches, soothing applications, &c., according to circumstances.

Sulphuric acid, in its concentrated state, acts as a powerful corrosive poison, eagerly combining with the organic bases and water of the tissues, corroding the mouth, gullet, and stomach, which are at first white, but ultimately are charred and black. When diluted, it acts, according to its strength, either as a corrosive, or simply as an irritant; or if still more diluted, as an astringent, tonic, and refrigerant. The strong acid has been used as an escharotic. As a poison, sulphuric acid has frequently caused death, both accidentally and designedly. It has been swallowed by mistake for castor oil, in consequence of its oily appearance. One drachm has caused death in an adult; but as much as two ounces, or even more, have been taken, followed by recovery, the poisonous effects being greatest when the stomach is empty. The symptoms of poisoning begin the moment the acid touches the mouth and throat; they consist of intense burning pain in the *primæ viæ*, vomiting of dark-coloured matters, which are acid, contain shreds of disorganised tissues, and more or less of blood; breathing, speaking, and swallowing are performed with great pain and difficulty; the voice is husky, and the breath fetid; the abdomen is swollen and very tender; the skin is cold and clammy, the pulse small, weak, and frequent, and ultimately fatal collapse ensues. The intellect being unimpaired, the patient feels his dreadful sufferings most keenly and anxiously. Death usually takes place within twenty-four hours, but it may be rapid and sudden, as by suffocation, if the air-passages are much implicated, or by perforation of the stomach; or, on the other hand,

death may result from secondary causes several days, weeks, or months afterwards. Stricture of the œsophagus, chronic vomiting, or other secondary cause, may ultimately prove fatal.

Diluted and aromatic sulphuric acids act as tonics, astringents, and refrigerants, and are employed in a variety of cases. They are given to check profuse perspiration, diarrhœa, and hemorrhage. They are employed in the night-sweats of phthisis, in combination with opium in ordinary diarrhœa, in the diarrhœa which is premonitory of cholera, and in cholera itself; in passive hemorrhages from the stomach, bowels, lungs, and uterus; in leucorrhœa and other debilitating discharges; and as refrigerants in fevers. The diluted acids are also employed for the prevention and cure of saturnine poisoning; both internally and topically in certain skin diseases; in syphilis; in ptyalism; in certain calculous affections, with alkaline urine, &c. When long continued, these, like the other mineral acids, impair the digestive functions; they also injure the teeth, which should be protected, when the dose is taken, by making the patient sip the acid through a quill. Its disagreeably acid taste is best covered by sugar. Externally, the concentrated acid has been applied as a cauterant to the bites of rabid animals; to produce a cicatrix for the cure of entropion, &c. Besides the diluted and aromatic forms, sulphuric acid exists free in the acid infusion of roses, and in combination is a constituent of numerous preparations.

ACIDUM HYDROCHLORICUM. *Synonyms:* Hydrochloric Acid, HCl, dissolved in water—Acidum Muriaticum Purum—Muriatic Acid—Spirit of Salt—Acide Hydrochlorique——Salzsäure—Chlorwasserstoffsäure.

Preparation.—*Take of chloride of sodium, dried,* 48 *ounces; sulphuric acid,* 44 *fluid ounces; water,* 36 *fluid ounces; distilled water,* 50 *fluid ounces. Pour the sulphuric acid slowly into thirty-two ounces of the water, and when the mixture has cooled add it to the chloride of sodium, previously introduced into a flask having the capacity of at least one gallon. Connect the flask by corks and a bent glass tube with a three-necked wash bottle, furnished with a safety tube, and containing the remaining four ounces of the water; then, applying heat to the flask, conduct the disengaged gas into a second bottle containing the distilled water, by means of a bent tube dipping about half an inch below the surface; and let the process be continued until the product measures sixty-six ounces, or the liquid has acquired a specific gravity of* 1·16. *The bottle containing the distilled water must be kept cool during the whole operation.*

Rationale.—$NaCl + H_2SO_4 = NaHSO_4 + HCl$, one equivalent of sulphuric acid and one of chloride of sodium are resolved into one equivalent of bisulphate of soda, and one of hydrochloric acid gas, the latter of which passes first through the wash bottle, which removes certain im-

purities, and then to the larger bottle to be dissolved in the distilled water.

CHARACTERS.—*A nearly colourless and strongly-acid liquid, emitting white vapours having a pungent odour.*[1] *It gives, with nitrate of silver, a curdy white precipitate, soluble in excess of ammonia, insoluble in nitric acid.*[2]

[1] If a glass rod dipped in solution of ammonia be held over the acid, the white fumes become much denser. [2] By the addition of an excess of ammonia, the insoluble chloride is converted into the soluble ammonio-chloride of silver.

PURITY TESTS.—*Specific gravity* 1·16.[1] *When evaporated to dryness it leaves no residue;*[2] 114·8 *grains by weight, mixed with half-an-ounce of distilled water, require for neutralisation* 1000 *grain measures of the volumetric solution of soda.*[3] *When diluted with four volumes of distilled water, it gives no precipitate with solution of chloride of barium,*[4] *or with sulphuretted hydrogen,*[5] *and does not tarnish or alter the colour of bright copper foil when boiled with it.*[6] *If a fluid drachm of it mixed with half-an-ounce of distilled water be put into a small flask with a few pieces of granulated zinc, and, while the effervescence continues, a slip of bibulous paper wetted with solution of subacetate of lead be suspended in the upper part of the flask above the liquid for about five minutes, the paper will not become discoloured.*[7]

[1] The addition of water reduces the density. [2] Absence of fixed impurities. [3] Equivalent to 36·5 grains of anhydrous acid, corresponding to 31·8 per cent. [4] Absence of sulphuric acid. [5 & 6] Absence of chlorine, lead, and arsenic. Chlorine may also be detected by its effect upon gold leaf. [7] This test proves the absence of sulphurous acid, which, if present, would be decomposed—by the hydrogen liberated by the zinc—into sulphuretted hydrogen and water; thus $SO_2 + H_6 = H_2S + 2H_2O$. The sulphuretted hydrogen gas escaping would form a black sulphide of lead on the prepared paper.

ACIDUM HYDROCHLORICUM DILUTUM — *Dilute Hydrochloric acid.—Take of hydrochloric acid,* 8 *fluid ounces; distilled water, a sufficiency. Dilute the acid with* 16 *ounces of the water, then add more water, so that at a temperature of* 60° *it shall measure* 26½ *fluid ounces; or as follows:—*

Take of hydrochloric acid, 3060 *grains; distilled water, a sufficiency; weigh the acid in a glass flask, the capacity of which, to a mark on the neck, is one pint; then add distilled water until the mixture at* 60° *temperature, after it has been shaken, measures a pint.*

TESTS.—*Specific gravity* 1·052. 345 *grains by weight* (*six fluid drachms*), *require for neutralisation* 1000 *grain measures of the volumetric solution of soda, corresponding to* 10·58 *per cent. of real acid. Six fluid drachms contain* 1 *equivalent, or* 36·5 *grains of hydrochloric acid, HCl.*

Dose.—The strong acid is used only externally; the diluted acid is given in doses of ten to thirty minims and upwards, sufficiently diluted; as a gargle, one to two drachms to eight ounces of infusion of roses, or decoction of bark.

Antidotes.—Alkaline bicarbonates and carbonates, magnesia, demulcents, milk; subsequent treatment, according to circumstances, similar to cases of poisoning by sulphuric acid.

M

Concentrated hydrochloric acid acts as a powerful corrosive poison, but poisoning by it is comparatively rare, and the symptoms resemble those of poisoning by sulphuric acid. It has been recommended as a topical application in cases of hospital gangrene, gangrenous stomatitis, scrofulous ulcers, and others of feeble vitality, aphthous, mercurial, and other ulcers of the mouth, tongue, and tonsils, diphtheria, malignant or putrid sore throat, warts, &c. In these cases it is applied either by means of a pointed piece of wood or a sponge, and of a strength varying with the circumstances. The diluted acid is administered internally as an alterative, tonic, and antalkaline, and has been used in cases of atonic dyspepsia, general debility, scrofula, phthisis, combined with a vegetable bitter in diseases of the liver, whether of scrofulous or specific origin, urinary affections with phosphatic deposits, diabetes, secondary syphilis, typhus and typhoid fevers, scarlatina, chronic hooping-cough, &c., and as a gargle in ulcerated sore throat.

ACIDUM NITRICUM ($2HO,NO_5+3HO$, or $2HNO_3 3H_2O$). *Synonyms:* Nitric Acid—Aqua Fortis—Spiritus Nitri Glauberi—Acide Nitrique—Saltpetersäure.

An acid prepared from nitrate of potash, or nitrate of soda by distillation with sulphuric acid and water, and containing 70 per cent. by weight of the nitric acid (HNO_3) corresponding to 60 per cent. of anhydrous nitric acid (N_2O_5). The reaction is $KNO_3+H_2SO_4=KHSO_4+HNO_3$.

Characters and Tests.—*A colourless liquid, having a specific gravity of* 1·42.[1] *When exposed to the air it emits an acrid corrosive vapour. If it be poured over copper filings, dense red vapours are immediately formed.*[2] *But if the acid be mixed with an equal volume of water, and then added to the copper, it gives off a colourless gas, which acquires an orange-red colour as it mixes with the air, and which, if it be introduced into a solution of sulphate of iron, communicates to it a dark purple or brown colour.*[3] *The boiling point of the acid is* 250°.[4] *If submitted to distillation, the product continues uniform throughout the process.*[5] *It leaves no residue when evaporated to dryness.*[6] *Diluted with six times its volume of distilled water, it gives no precipitate with chloride of barium*[7] *or nitrate of silver.*[8] 90 *grains by weight of it mixed with half-an-ounce of distilled water require for neutralisation* 1000 *grain measures of the volumetric solution of soda.*[9]

[1] The acid now employed is of less specific gravity than was formerly used, as it is found that acid of specific gravity 1·42 is much more stable than any other. [2] Of N_2O_4. [3] Nitric oxide, N_2O_2, which, when mixed with air, absorbs oxygen, forming N_2O_4, the orange red fumes ; it also forms a black solution with sulphate of iron. [4] Peculiar to this strength of acid. [5] If the proportion of acid to water is greater than 70 per cent. on distillation, acid escapes until the density 1·42 is reached, and if less than 70 per cent., water escapes, at which density alone the product of distillation is uniform throughout. [6] Absence of fixed impurities.

[7] Absence of sulphuric acid. [8] Absence of hydrochloric acid. [9] 90 grains contain an equivalent (63 grains) of HNO_3, equal to 70 per cent.

ACIDUM NITRICUM DILUTUM—*Diluted nitric acid.—Take of nitric acid* 6 *fluid ounces; distilled water, a sufficiency. Dilute the acid with* 24 *fluid ounces of the water, then add more water, so that at a temperature of* 60° *it shall measure* 31 *fluid ounces; or as follows:—*

Take of nitric acid 2400 *grains; distilled water, a sufficiency: weigh the acid in a glass flask, the capacity of which, to a mark made on the neck, is one pint; then add distilled water until the mixture at* 60° *after it has been shaken measures a pint.*

TESTS.—*Colourless. Specific gravity* 1·101. 361·3 *grains by weight* (*six fluid drachms*) *require for neutralisation* 1000 *grain measures of the volumetric solution of soda, corresponding to* 14·95 *per cent. of anhydrous nitric acid; six fluid drachms, therefore, correspond to* 54 *grains of the anhydrous acid (one equivalent of NO_5, or half an equivalent of N_2O_5).*

ACIDUM NITRO-HYDROCHLORICUM DILUTUM—*Diluted nitro-hydrochloric acid.—Take of nitric acid,* 3 *fluid ounces; hydrochloric acid,* 4 *fluid ounces; distilled water,* 25 *fluid ounces. Mix the acids, and allow them to remain for twenty-four hours in a bottle, the mouth of which is partially closed; then add the water in successive portions, shaking the bottle after each addition, and preserve the mixture in a stoppered bottle.*

TESTS.—*Colourless. Specific gravity* 1·074. 352·4 *grains by weight* (*six fluid drachms*) *require for neutralisation* 920 *grain measures of the volumetric solution of soda.*

Dose.—Concentrated nitric acid is used only externally; diluted nitric acid, and diluted nitro-hydrochloric acid in doses of ten to thirty minims in a suitable vehicle.

Antidotes.—Same as for sulphuric acid.

Concentrated nitric acid acts as a powerful corrosive poison, the symptoms of which and their treatment resemble those mentioned under sulphuric acid. The strong acid is used externally as a caustic application to phagedenic ulcers, hospital gangrene, poisoned wounds, the bites of rabid animals and poisonous vermin, condylomata, chancres, hæmorrhoids, warts, corns, carious bones, chilblains, &c. Internally, the diluted acid has been employed as an alterative, tonic, refrigerant, and antalkaline. It has been recommended in syphilitic cases in which mercury has either been previously given or is not desirable, and in rheumatic cases complicated with syphilis, under similar circumstances; in chronic affections of the liver and spleen; in diabetes; in atonic dyspepsia, especially with a vegetable bitter; in urinary affections with phosphatic deposits; in intermittent fevers; and also in typhus and typhoid fevers; in hooping-cough; in cholera, dysentery, and diarrhœa. It has been also injected into the bladder in cases of chronic inflammation, and

for the solution of phosphatic calculi. In the form of liniment it has been used in some skin diseases and in alopœcia; and as a gargle in throat affections. It is also used as a fumigating and disinfecting agent. Its vapours, when incautiously inhaled, induce most intense capillary bronchitis. This has led to fatal results on several occasions.

Nitro-hydrochloric acid in the concentrated form *(Aqua Regia)* is not officinal, but it is occasionally used as a caustic. The diluted nitro-hydrochloric acid is employed, both internally and in the form of bath, as a tonic and alterative, and as a topical stimulant. It has been employed in chronic affections of the liver and spleen, in jaundice, and in dropsies proceeding from derangement of these organs, in which cases it is given internally, applied as a lotion to the region of the liver, as well as used as a pediluvium; in syphilis, both internally, externally, and as a gargle; in urinary affections, as in the phosphatic, oxalic acid, and cystic oxide diatheses; in gangrene of the lungs as an antiseptic; in scarlatina both internally and as a gargle; as a lotion in certain skin diseases, as acne rosacea; in cholera; in epilepsy; in atonic dyspepsia; in chronic rheumatism; in indolent ulcers; in the scrofulous cachexia, &c.

Acidum Chromicum (CrO_3)—Chromic Acid—Chromic Anhydride—may be prepared by the action of sulphuric acid upon a solution of bichromate of potash. It occurs either in distinct deep red acicular crystals, or as a crystalline mass of a scarlet-red colour. It is readily soluble in water, giving it a reddish-brown tint, and deliquesces when exposed to the atmosphere. It dissolves organic matter, acting as a powerfully oxidising and bleaching agent. Medicinally, it is only used externally as a caustic to destroy morbid growths, condylomata, warts, corns, cancerous tissue, hæmorrhoids, &c.; to improve the condition of certain ulcers, &c. It is a powerful and deeply penetrating caustic, slow of action when applied as a paste, and causing less pain than many other agents of the same class; in solution it readily dissolves the tissues to which it is applied, for which purpose it is used for the removal of condylomata, warts, &c.

Acidum Carbonicum (CO_2)—Carbonic Acid—Carbonic Anhydride—Choke-Damp — Acide Carbonique — Köhlensäure — at the ordinary temperature of the atmosphere, is a colourless, transparent, inodorous, and sourish gas, but by pressure may be solidified. It is heavier than the atmosphere, its specific gravity being 1·525, and in some situations, as in the *Grotto del Cane*, near Naples, and in the Valley of Poisons, in Java, it is constantly present in such quantity as to cause the death of animals exposed to its influence; and but for the diffusive property of gases, this poisonous substance would gravitate to the surface of the earth and put an end to vitality. It has an acid reaction, is readily absorbed by solutions of potash and lime, and to a certain extent in water. The aqueous solution

of carbonic acid is feebly and transiently acid. Under pressure, water may be made to absorb a considerable quantity, the excess of gas escaping forcibly on the removal of the pressure. Carbonic acid gas may be obtained by decomposing any of the carbonates by means of a strong acid. Undiluted, it is irrespirable, producing spasmodic closure of the glottis and asphyxia ; when diluted, it acts upon the brain, producing drowsiness, a feeling of fulness and tension in the head, throbbing headache, impaired vision, tinnitus aurium, giddiness, loss of muscular power, somnolency, stupor or coma, with lividity of countenance, general venous congestion, and sometimes delirium and convulsions. It often proves fatal in mines (Choke-Damp), brewers' vats, wells, caverns, &c. The indications of treatment are to aërate the blood by exposing the patient to free air, to produce respiratory efforts by shocks of galvanism or cold affusion, or artificially if necessary, and to relieve congestion by moderate general or local blood-letting. Medicinally, carbonic acid gas has been used as a general anæsthetic, and also as a local anæsthetic to afford relief from the pain occasioned by cancerous and other affections of the uterus, cancerous wounds, sciatica, and other neuralgic affections, dysentery, and diseases of the rectum, &c. By inhalation it has been used with great success in the treatment of spasmodic asthma, and of chronic bronchitis, and emphysema. It has been used injected locally to produce premature labour. Internally, in the form of *aqua acidi carbonici*, soda water, potash water, acidulous mineral waters, &c., carbonic acid is given to subdue nausea and vomiting, to allay irritability of the stomach, to obviate the tendency to certain urinary deposits, &c. Effervescing drinks are suitable vehicles for the administration of many medicines which irritable stomachs will not bear when given in any other manner.

Acidum Hydrosulphuricum (HS, or H_2S) — Hydro-Sulphuric Acid—Sulphuretted Hydrogen.

PREPARATION.—*Take of sulphuret of iron, ½ ounce; water, 4 fluid ounces; sulphuric acid of commerce, a sufficiency. Place the sulphuret of iron and the water in a gas bottle closed with a cork perforated by two holes, through one of which pass, air-tight, a funnel tube of sufficient length to dip into the water, and through the other a tube for giving exit to the gas. Through the former pour from time to time a little of the acid, so as to develop the sulphuretted hydrogen according as it is wanted.*

Rationale.—$FeS + H_2SO_4 = H_2S + Fe\ SO_4$. Sulphuretted hydrogen, at the ordinary temperature of the atmosphere, is a colourless gas, of a nauseous rotten egg-like odour, inflammable, feebly and transiently reddening litmus paper, and soluble in water. The solution of sulphuretted hydrogen gas in water is colourless, and emits an offensive rotten egg-like odour. It is useful as a test, in consequence of its strong tendency to interchange with metallic oxides forming water and metallic sulphides—the latter of which, being in several instances insoluble in water, afford characteristic precipitates. Sulphuretted hydrogen is poisonous even when largely diluted with atmospheric air; it is produced in sewers, and by the putrefaction of animal tissues. Chlorine decomposes the gas, and therefore chloride of lime, or solutions of chlorine, may be used as antidotes. Sulphuretted hydrogen occurs also in the class of sulphurous mineral waters, previously mentioned.

Group II.— Acetic, Tartaric, Citric, Oxalic, Boracic.

ACIDUM ACETICUM GLACIALE ($HO,C_4H_3O_3$, or $HC_2H_3O_2$)—Glacial Acetic Acid—Monohydrated Acetic Acid.

Concentrated acetic acid, corresponding to at least 84 per cent. of anhydrous acid, $C_4H_6O_3$.

Prepared by treating fused acetate of soda with sulphuric acid and distilling.

Characters.—*It crystalizes when cooled to* 34°, *and remains crystalline until the temperature rises above* 48°. *Specific gravity* 1·063 to 1·065, *and this is increased by adding* 10 *per cent. of water. At the mean temperature of the air it is a colourless liquid, with a pungent acetous odour.*

The density of the liquid continues to increase on the addition of water, until the mixture consists of one equivalent of anhydrous acid to three equivalents of water. At this point of dilution the acid attains its maximum density (1·073), and on further dilution the specific gravity diminishes, so that when a sufficiency of water has been added, it again arrives at the density of 1·065, namely, that of the strong monohydrated acid. Therefore, the mere density would form no criterion of the strength of the acid; it is essential to know whether it increases or diminishes on the addition of water.

Tests.— 60 *grains by weight mixed with a fluid ounce of distilled water require for neutralisation at least* 990 *grain measures of the volumetric solution of soda.*[1] *If a fluid drachm of it, mixed with half an ounce of distilled water and half a drachm of pure hydrochloric acid, be put into a small flask with a few pieces of granulated zinc, and, while the effervescence continues, a slip of bibulous paper wetted with solution of subacetate of lead be suspended in the upper part of the flask above the liquid for about five minutes, the paper will not become discoloured.*[2]

[1] 60 grains contain 50·49 grains of anhydrous, corresponding to 84 per cent. [2] Proves the absence of sulphurous acid, which if it were present would be decomposed by the hydrogen forming sulphuretted hydrogen, and this latter escaping would blacken the lead in the paper.

Glacial acetic acid acts as an irritant, rubefacient, vesicant, and escharotic. It is but seldom used even externally, and never internally, except in the form of aromatic vinegar, the stronger acetic acid being generally employed in its stead. It is sometimes used to destroy corns, warts, &c.; and, painted over the part, as a vesicant, in cases in which there is intolerance of cantharides. It is used in the preparation of the officinal *Mistura Creasoti*, and *Acetum Cantharides;* also in the preparation of aromatic vinegar.

ACIDUM ACETICUM—Acetic Acid—Purified Pyroligneous Acid. An acid liquid prepared from wood by destructive distillation, and subsequent purification; 100 parts by weight contain 33 parts of the acetic acid $HC_2H_3O_2$, corresponding to 28 parts of anhydrous acetic acid $C_4H_6O_3$.

Beech, oak, birch, and other hard and non-terebinthinous woods are employed in the preparation of acetic acid. They are first dried, and then heated in iron retorts. The products are partly gaseous, which are carried into the furnace to serve as fuel, and partly liquid, amongst which is impure acetic acid. In order to purify this, it is saturated either by soda or by chalk, whereby the acetate of soda or lime is formed. This salt is heated sufficiently to drive off the tarry matters which accompanied the acid, but carefully, so as not to decompose the salt itself. The acetate is next purified by repeated solution and crystallisation, and finally it is distilled with diluted sulphuric acid, which, by seizing upon the base to form sulphate of soda or lime, allows the acetic acid to pass over, and this is again purified by re-distillation.

CHARACTERS.—*A colourless liquid, having a strong acid reaction and a pungent odour.*

PURITY TESTS.—*Specific gravity* 1·044. 182 *grains by weight require for neutralisation* 1000 *grain measures of the volumetric solution of soda.*[1] *It leaves no residue when evaporated;*[2] *and gives no precipitate with sulphuretted hydrogen,*[3] *chloride of barium,*[4] *or nitrate of silver;*[5] *if a fluid drachm of it, mixed with half-an-ounce of distilled water and half a drachm of pure hydrochloric acid, be put into a flask with a few pieces of granulated zinc, and while the effervescence continues, a slip of bibulous paper wetted with solution of subacetate of lead be suspended in the upper part of the flask above the liquid for about five minutes, the paper will not become discoloured.*

[1] Equivalent to 33 per cent. of monohydride, and 28 per cent. of anhydrous acid. [2] Absence of fixed impurities. [3] Absence of lead and other metallic impurities. [4] Absence of sulphuric acid. [5] Absence of hydrochloric acid. [6] Absence of sulphurous acid.

ACIDUM ACETICUM DILUTUM—*Diluted acetic acid.—Take of acetic acid,* 1 *pint; distilled water,* 7 *pints; mix.*

TESTS.—*Specific gravity* 1·006. 440 *grains by weight (one fluid ounce) require for neutralisation* 313 *grain measures of the volumetric solution of soda, corresponding to* 3·63 *per cent. of anhydrous acetic acid. One fluid ounce, therefore, corresponds to* 16 *grains of anhydrous acid.*

OXYMEL—*Oxymel.—Take of clarified honey,* 40 *ounces; acetic acid,* 5 *fluid ounces; distilled water,* 5 *fluid ounces. Liquefy the honey by heat, and mix with it the acetic acid and water.*

Dose.—Of the diluted acid, one drachm or more, sufficiently diluted; of oxymel, one to three or four drachms, added to gargles or cough mixtures.

Strong acetic acid is occasionally used externally as a rubefacient, vesicant, and escharotic; to destroy morbid growths, venereal vegetations, warts, corns, &c.; to remove nævi; to produce vesication in cases in which there is intolerance of cantharides; as an application to tinea capitis, psoriasis, &c. It dissolves cantharidine and

enters into the officinal *Liquor Epispasticus.* Internally, the strong acid acts as a powerful corrosive poison, the symptoms and treatment resembling those of poisoning by the mineral acids. The diluted acid acts as a refrigerant and astringent, and may be used in the same manner as vinegar, both internally, and also externally either in form of lotion or for sponging the body in fevers and colliquative sweating. Oxymel is used as an adjunct to astringent gargles, and is given internally as an expectorant and diaphoretic. Dilute acetic acid is also employed for fumigation in the sick-room.

ACETUM—Vinegar, an acid liquid prepared from malt and unmalted grain by the acetous fermentation.

Vinegar may be obtained from a variety of substances, and varies in its quality according to its source. In this country it is prepared from malt, beer, cider, sugar dissolved in water with the addition of a little brandy and yeast, and from other sources ; but in France it is prepared from wines by simply exposing them freely to the influence of the atmosphere, adding a little vinegar to start the process. *Acetification*, as the process is termed, consists in the conversion of alcohol into aldehyd and water, and the former of these into hydrated acetic acid : thus, C_2H_6O (alcohol), by the abstraction of two atoms of hydrogen, by the action of the oxygen of the atmosphere, becomes C_2H_4O (aldehyd) + H_2O (water); and the aldehyd, abstracting another equivalent of oxygen from the atmosphere, becomes hydrated acetic acid : $C_2H_4O + O = C_2H_4O_2$. The vinegar of commerce consists of this acetic acid diluted and contaminated with organic impurities.

CHARACTERS.—*A liquid of a brown colour and peculiar odour.*

PURITY TESTS.—*Specific gravity* 1·017 *to* 1·019.[1] 445·4 *grains by weight* (*one fluid ounce*) *of it require at least* 402 *grain measures of the volumetric solution of soda for their neutralisation, corresponding to* 4·6 *per cent. of anhydrous acetic acid. If* 10 *minims of solution of chloride of barium be added to a fluid ounce of the vinegar, and the precipitate, if any, be separated by filtration, a further addition of the test will give no precipitate.*[2] *Sulphuretted hydrogen causes no change of colour.*[3]

[1] Its density depends upon the amount of foreign substances present, and does not indicate the strength of the acid. [2] Showing the presence of only a small quantity of sulphuric acid, which is allowed by law to preserve the vinegar. [3] Absence of metallic impurities.

Dose.—One to several drachms, either alone or diluted. As a drink, well diluted, *ad libitum.*

Vinegar acts as a refrigerant, astringent, and antalkaline. Diluted with water, it is used as a wash to sponge the body in fevers, phthisis, internal hemorrhages and inflammations, purpura, &c. It reduces the preternatural heat in fevers, tranquillising the patient, and predisposing to sleep ; it checks the night sweats and hæmoptysis of

phthisis ; tends to avert internal hemorrhages, as of the uterus, hæmorrhoidal, &c., and to diminish internal inflammatory action, when applied near to the part affected. It is applied to the breasts in cases of painful distension with milk, and to prevent suppuration. It has been used as an application to burns and scalds, as a collyrium to remove lime from the eye, and in the undiluted form as an application to hospital gangrene. Inhaled in the form of vapour, or used as a gargle, it is applied as an astringent to the relaxed uvula and to the relaxed and ulcerated sore throat ; as an injection, or by means of lint soaked in it, it is used to arrest epistaxis ; as an enema, it is injected into the large intestine to arrest hemorrhage, and for a similar purpose it is injected into the vagina. Internally, vinegar is used as a refrigerant and astringent, and also as an antalkaline ; it is employed, well diluted, as a drink in fevers to allay thirst and reduce the heat of the body, and also for the purpose of arresting preternatural discharges. It is sometimes resorted to by the corpulent to reduce their bulk, a result which it effects by interfering with the functions of digestion and assimilation. It is used as an antidote in poisoning by the alkalies and their carbonates, and also for fumigation in the sick-room.

ACIDUM TARTARICUM ($2HO,C_8H_4O_{10}$, or $H_2C_4H_4O_6$)—Tartaric Acid—Acide Tartarique—Acide Tartareux. A crystalline acid prepared from the acid tartrate of potash.

PREPARATION.—*Take of acid tartrate of potash,* 45 *ounces; distilled water, a sufficiency; prepared chalk,* $12\frac{1}{2}$ *ounces; chloride of calcium,* $13\frac{1}{2}$ *ounces; sulphuric acid,* 13 *fluid ounces. Boil the acid tartrate of potash with two gallons of the water, and add gradually the chalk, constantly stirring. When the effervescence has ceased, add the chloride of calcium dissolved in two pints of the water. When the tartrate of lime has subsided, pour off the liquid, and wash the tartrate with distilled water until it is rendered tasteless. Pour the sulphuric acid, first diluted with three pints of the water, on the tartrate of lime, mix thoroughly, boil for half an hour with repeated stirring, and filter through calico. Evaporate the filtrate at a gentle heat until it acquires the specific gravity of* 1·21, *allow it to cool, and then separate and reject the crystals of sulphate of lime which have formed. Again evaporate the clear liquor till a film forms on its surface, and allow it to cool and crystallise. Lastly, purify the crystals by solution, filtration (if necessary), and recrystallisation.*

Rationale.—By boiling acid tartrate of potash with chalk, two neutral tartrates are obtained, namely, of lime and potash ; thus, $2KHC_4O_6 + CaCO_3 = K_2C_4H_4O_6 + CaC_4H_4O_6 + H_2O + CO_2$. The tartrate of lime is precipitated, and the tartrate of potash is left in solution. Then, on the addition of the chloride of calcium, the tartrate of potash is converted into tartrate of lime, which is also precipitated, chloride of potassium being left in solution ; thus, $K_2C_4H_4O_6 + CaCl_2 = CaC_4H_4O_6 + 2KCl$.

Then, lastly, the sulphuric acid decomposes the tartrate, to form sulphate of lime, which is precipitated, and leaves the tartaric acid in solution, thus, $CaC_4H_4O_6 + H_2SO_4 = CaSO_4 + H_2C_4H_4O_6$. The sulphate of lime being but sparingly soluble in water, is entirely removed from the solution by evaporating the liquid to a density of 1·21.

CHARACTERS.—*In colourless crystals, the primary form of which is the oblique rhombic prism, it has a strongly acid taste, and is readily soluble in water and in rectified spirit. When to either solution, not too much diluted, a little acetate of potash is added, a white crystalline precipitate is formed.*

The crystals are inodorous and permanent in the atmosphere. [1]Acid tartrate of potash, or cream of tartar.

PURITY TESTS.—*Seventy-five grains of crystallised tartaric acid dissolved in water require for neutralisation* 1000 *grain measures of the volumetric solution of soda.*[1] *An aqueous solution of the acid is not affected by sulphuretted hydrogen,*[2] *and gives no precipitate with the solution of sulphate of lime,*[3] *or of oxalate of ammonia.*[4] *It leaves no residue, or only a mere trace, when burned with free access of air.*[5]

[1] If the acid contained impurities, this would be modified accordingly. [2] Absence of lead and other metallic impurities. [3] Absence of oxalic acid. [4] Absence of lime. [5] Absence of lime and other fixed impurities.

Dose.—Ten to twenty or thirty grains dissolved in water and sweetened. To prepare effervescing draughts, twenty grains of the crystallised acid will saturate twenty-seven grains of crystallised bicarbonate of potash, twenty-two grains of crystallised bicarbonate of soda, thirty-three and a half grains of crystallised carbonate of soda, and fifteen and a half grains of hydrated sesquicarbonate of ammonia.

Tartaric acid in large doses acts as an irritant poison, and death has followed the administration of one ounce dissolved in half a pint of warm water. The symptoms and treatment resemble those of poisoning by oxalic acid. Medicinally, it is used as a refrigerant drink, well diluted with water, in febrile and inflammatory cases. It has been recommended as a solvent of mucus in the alimentary canal in certain cases of dyspepsia ; but it is chiefly used to prepare effervescing draughts, for which it is cheaper but not so agreeable as citric acid. It enters into the constitution of *Seidlitz Powders.*

ACIDUM CITRICUM ($3HO,C_{12}H_5O_{11} + 2HO$, or $H_3C_6H_5O_7H_2O$) —Citric Acid. A crystalline acid obtained from lemon juice, or from the juice of the fruit of *Citrus Limetta* (Risso), the Lime.

PREPARATION.—*Take of lemon juice,* 4 *pints; prepared chalk,* 4½ *ounces; sulphuric acid,* 2½ *fluid ounces; distilled water, a sufficiency. Heat the lemon juice to its boiling point, and add the chalk by degrees, till there is no more effervescence. Collect the deposit on a calico filter, and wash it with hot water till the filtered liquor passes from it colourless. Mix the deposit with a pint of distilled water, and gradually add the sulphuric acid, previously diluted with a pint and a-half of distilled water; boil gently for*

half-an-hour, keeping the mixture constantly stirred. Separate the acid solution by filtration, wash the insoluble matter with a little distilled water, and add the washings to the solution. Concentrate this solution to the density of 1·21, *then allow it to cool, and after twenty-four hours decant the liquor from the crystals of sulphate of lime which will have formed; further concentrate the liquor till a film forms on its surface, and set it aside to cool and crystallise. Purify the crystals, if necessary, by re-crystallisation.*

Rationale.—On the addition of chalk, carbonic acid is given off, and insoluble citrate of lime is precipitated; thus, $2H_3C_6H_5O_7 + 3CaCO_3 + Ca_3 2C_6H_5O_7 + 3CO_2 + 3H_2O$; then, on the addition of sulphuric acid, sulphate of lime is precipitated, and citric acid left in solution; thus, $Ca_3 2C_6H_5O_7 + 3H_2SO_4 = 3CaSO_4 + 2H_3C_6H_5O_7$. The sulphate of lime being but sparingly soluble in water, is entirely removed from the solution by evaporating the liquid to a density of 1·21.

CHARACTERS.—*In colourless crystals, of which the right rhombic prism is the primary form, very soluble in water, less soluble in rectified spirit, and insoluble in pure ether. The crystals dissolve in three-fourths of their weight of cold, and in half their weight of boiling water. The diluted aqueous solution has an agreeable acid taste. When the solution is made by dissolving* 34 *grains of the acid in one ounce of water, it resembles lemon juice in its strength and in the nature of its acid properties, and, like lemon juice, it undergoes decomposition and becomes mouldy by keeping.*

The crystals are insoluble in ether, are inodorous, and are permanent in the atmosphere. When citric acid is added to lime water, the solution remains clear until it is boiled, when it becomes turbid, and deposits citrate of lime.

PURITY TESTS.—*The aqueous solution is not darkened by sulphuretted hydrogen,*[1] *gives no precipitate when added in excess to solution of acetate of potash*[2], *or of chloride of barium,*[3] *and if sparingly added to cold lime water, it does not render it turbid.*[4] *The crystals leave no ash when burned with free access of air.*[5] *Seventy grains of the acid dissolved in distilled water are neutralised by* 1000 *grain measures of the volumetric solution of soda.*[6]

[1] Absence of metallic impurities, such as lead or copper. [2] Absence of tartaric acid. [3] Absence of sulphuric acid. [4] Absence of oxalic acid. [5] Absence of fixed impurities. [6] If the acid contained impurities, this would be modified accordingly.

Dose.—Ten to twenty or thirty grains dissolved in sufficient water and sweetened. To prepare effervescing draughts, seventeen grains (equal to half a fluid ounce of fresh lemon juice) will saturate twenty-five grains of bicarbonate of potash, twenty grains of bicarbonate of soda, twenty grains of carbonate of potash, thirty-five grains of carbonate of soda, fifteen grains of carbonate of ammonia, and thirteen grains of carbonate of magnesia.

Citric acid is occasionally used as a substitute for fresh lemon juice, to which it is inferior as a refrigerant and antiscorbutic. But it is chiefly used in the preparation of effervescing draughts, and enters into the constitution of the officinal citrates.

ACIDUM OXALICUM (HO,C_2O_3+2HO, or $H_2C_2O_42H_2O$)—Oxalic Acid—Acid of Sugar.

This acid occurs in the plant wood-sorrel, *Oxalis Acetosella,* and hence derives its name. It occurs also in many other plants. For commercial purposes it is prepared either by the action of nitric acid upon sugar, treacle, or starch, or by heating saw-dust with an alkali. The following directions may be employed for the purification of the commercial acid:—

Take of oxalic acid of commerce, 1 *pound; boiling distilled water,* 30 *fluid ounces. Dissolve, filter the solution, and set aside to crystallise. Pour off the liquor, and dry the crystals by exposure to the air on filtering paper placed on porous bricks.*

Test.—Is entirely dissipated by a heat below 350°.

Oxalic acid crystallises in transparent four-sided prisms, which are readily soluble in water and alcohol, are intensely sour, effloresce in dry air, fuse in their water of crystallisation at 212°, and sublime, without leaving any residue, at 320°. Oxalic acid has been sold in mistake for sulphate of magnesia or *Epsom salts,* and for sulphate of zinc or *white vitriol;* but oxalic acid may be distinguished from the others by the following characters:—1. It is entirely volatilised by heat, if pure; the others are fixed, after parting with their water of crystallisation. 2. Oxalic acid is intensely sour; sulphate of zinc much less so, and sulphate of magnesia neutral and bitter. 3. Nitrate of silver precipitates white oxalate of silver, which is soluble in cold nitric acid. 4. With solution of sulphate of lime, oxalic acid gives a white precipitate, which is soluble in nitric acid, but insoluble in the vegetable acids. 5. By evaporating a solution containing oxalic acid, the crystals bearing their distinguishing characters may be obtained.

Dose.—Half a grain to one or two grains, dissolved in water, and sweetened. As a drink, five grains, dissolved in half a pint of water, sweetened, may be given in the twenty-four hours; or in the form of lemonade.

Antidotes.—Chalk, magnesia, carbonate or bicarbonate of magnesia; these may be given in milk or water; but water tends to the diffusion and absorption of the poison, and, if freely given, it should be removed either by the stomach-pump or by emetics. Fluid (bicarbonate of) magnesia may be given. Lime water, with or without olive oil. The alkalies and their carbonates form poisonous salts with oxalic acid, and are therefore inadmissible. Subsequent treatment of collapse or other consequences, according to circumstances.

Oxalic acid in over-doses acts as a virulent poison, occasioning death sometimes within a few minutes, frequently within an hour, but occasionally after a longer interval, according to the quantity taken, the amount of fluid taken with it, and the state of the stomach at the time with regard to food. Death has followed the administration of a drachm of the acid, and recoveries have taken place after half an ounce has been swallowed. The symptoms immediately

following the administration of a large dose are an intensely sour taste, a burning sensation in the œsophagus and stomach, a choking or suffocating feeling of constriction in the throat, and great tenderness of the abdomen ; this is usually, but not invariably, followed by vomiting of dark greenish or brownish coloured matters, mixed with blood, and very acid. The skin is cold and clammy, the pulse small, weak, and frequent, the countenance anxious and expressive of great pain, and ultimately fatal collapse ensues, occasionally preceded by convulsions. If the patient recover from the immediate consequences, he may subsequently suffer from great pain in the *primæ viæ*, difficulty of swallowing, intense thirst, vomiting, &c. Medicinally, oxalic acid has been recommended as a refrigerant, sedative, and antiphlogistic, and has been given in acute inflammatory affections of the mucous membranes, especially of the stomach and respiratory organs ; it has been given also as a refrigerant drink in febrile cases, and has been used in phthisis.

ACIDUM BORACICUM ($BO_3 + 3HO$, or H_3BO_3). *Synonyms:* Boracic Acid—Boric Acid—Acide Boracique—Borax Säure.

Boracic acid is prepared by the action of Hydrochloric or sulphuric acid upon borax (biborate of soda). Hydrochloric acid is preferable.

Rationale.—($Na_2B_4O_7 10H_2O + 2HCl = 2NaCl + 5H_2O + 4H_3BO_3$.)

Boracic acid occurs in white scaly crystals of a pearly lustre, which are inodorous, of a slightly acid and bitter taste; are soluble in hot water and alcohol, less soluble in cold water, the solutions having a feebly acid reaction. The crystals are unctuous to the touch, and are fused by a red heat into a colourless transparent glass. The alcoholic solution burns with a green flame. Boracic acid is not much used in medicine now. It was formerly employed as a sedative in cerebral affections, in cardialgia, &c. It is introduced into the Appendix of the Pharmacopœia as a test for the purity of rhubarb. It renders cream of tartar more soluble when added to it. It enters into the constitution of borax.

CLASS III.—METALS.

Group I. Metals of the Alkalies—Potassium, Sodium, and Lithium, with which it is convenient to place Ammonia.

POTASSIUM ($K = 39$)—Potassium—Kalium—is a bluish-white, brittle metal; floats on water, and readily oxidises when exposed to the air. It is abundantly distributed throughout nature in combination with the acids, earths, and halogens. It is the metallic base of

Potassa Caustica (KO,HO, or KHO). *Synonyms:* Potassæ Hydras —Potassa Fusa—Kali Purum—Kali—Oxide of Potassium—Hydrate of Potash.

Preparation.—*Take of solution of potash,* 2 *pints. Boil down the*

solution of potash rapidly in a silver or clean iron vessel until there remains a fluid of oily consistence, a drop of which, when removed on a warm glass rod, solidifies on cooling. Pour this into proper moulds, and when it has solidified, and while it is still warm, put it into stoppered bottles.

CHARACTERS.—*In hard white pencils, very deliquescent, powerfully alkaline and corrosive. A watery solution acidulated by nitric acid gives a yellow precipitate with perchloride of platinum,*[1] *and only scanty white precipitates with nitrate of silver,*[2] *and chloride of barium.*[3]

It is met with also in irregular pieces, flattened, and of a somewhat crystalline texture, the crystals being octohedrons or tetrahedral pyramids. It is soluble in water and alcohol. It acts powerfully upon many organic substances, and in consequence of its action upon the cuticle, it has a soapy feel. When exposed to the air it is converted into the carbonate. [1] This is one of the most delicate tests for the presence of potash; the precipitate is the double chloride of potassium and platinum, $2KCl,PtCl_4$, the potassio-perchloride of platinum; it is insoluble in alcohol, and but very sparingly soluble in water. [2] Indicating the presence of a little chloride of potassium, [3] and of carbonate or sulphate of potash.

PURITY TESTS.—*Fifty-six grains dissolved in water leave only a trace of sediment,*[1] *and require for neutralisation at least* 900 *grain measures of the volumetric solution of oxalic acid.*[2]

[1] A small quantity of silica. [2] If there be impurities present (and it is rarely quite pure) less of the volumetric solution will saturate it.

Antidotes.—Dilute acetic acid, vinegar, citric acid, lemon juice, orange juice, fixed oils; demulcents.

Caustic potash is a powerful escharotic and corrosive irritant poison. The symptoms of poisoning consist of the disagreeable acrid and caustic taste of the potash, burning pain in the mouth, throat, œsophagus, and stomach, generally vomiting of dark-brown coloured matters which are alkaline, and contain blood and shreds of mucous membrane, great tenderness of the abdomen, with colicky pains and purging; skin cold and clammy, pulse small, weak, and frequent; hiccough, &c. The mouth and fauces are tense, red, and corroded. Sometimes the larynx is implicated, and death is caused by asphyxia. Death may take place by collapse within a few hours or days of the poisoning, or subsequently by exhaustion. Medicinally, caustic potash is used only externally as an escharotic to form issues, to destroy morbid growths, to remove nævi, to obliterate varicose veins, to arrest hospital gangrene, to open deep-seated and chronic abscesses and bubos, to overcome strictures of the urethra, to destroy hypertrophied and ulcerated portions of the os and cervix uteri, &c.

The chief hindrance to the application of caustic potash is its deliquescence. To obviate this, it has been prepared in a variety of

ways: *Potassa cum calce* consists of equal parts of lime and caustic potash; it is less energetic than the pure caustic, but is also less troublesome to use. *Vienna Paste* is a modification of the above, made by powdering together potassa cum calce and quicklime in the proportions of five of the former to six of the latter; the powder is made into a paste with spirit when required. Gutta percha may be combined with potassa with the same object.

Liquor Potassæ—Solution of Potash—Caustic Potash dissolved in water.

PREPARATION.—*Take of carbonate of potash,* 1 *pound; slaked lime,* 12 *ounces; distilled water,* 1 *gallon. Dissolve the carbonate of potash in the water; and, having heated the solution to the boiling-point in a clean iron vessel, gradually mix with it the slaked lime; and continue the ebullition for ten minutes with constant stirring. Then remove the vessel from the fire; and when by the subsidence of the insoluble matter the supernatant liquor has become perfectly clear, transfer it by means of a siphon to a green-glass bottle furnished with an air-tight stopper, and add distilled water, if necessary, to make it correspond with the tests of specific gravity and neutralising power.*

Rationale.—$K_2CO_3 + CaH_2O_2 = CaCO_3 + 2KHO$. The slaked lime abstracts the carbonic acid from the potash salt, carbonate of lime is precipitated, and caustic potash is left in solution; boiling renders the decomposition of the carbonate more prompt. The siphon is used instead of a filter to separate the precipitate, because the potash acts upon organic substances; and during the exposure to the atmosphere, would be partially converted into carbonate. It acts upon the lead of white flint-glass, and therefore must be kept in green-glass bottles. The solution is colourless, transparent, inodorous; has a soapy feel in consequence of its action upon the cuticle, an acrid caustic taste, corrodes both animal and vegetable substances, and is strongly alkaline.

PURITY TESTS.—*Specific gravity* 1·058. 462·9 *grains by weight*[1] (1 *fluid ounce*) *require for neutralisation* 482 *grain-measures of the volumetric solution of oxalic acid, corresponding to* 5·84 *per cent. by weight of hydrate of potash, KO,HO, or KHO.*[2] *It does not effervesce when added to an excess of diluted hydrochloric acid;*[3] *mixed with an equal volume of distilled water, it gives no precipitate with solution of lime*[4] *or oxalate of ammonia.*[5] *When it is treated with an excess of diluted-nitric acid, and evaporated to dryness, the residue forms with water a nearly clear solution, which may be slightly precipitated by chloride of barium*[6] *and nitrate of silver,*[7] *but is unaffected, or but very slightly affected, by ammonia.*[8] *One fluid ounce contains* 27 *grains of hydrate of potash.*

[1] Equal to about 4·7 per cent. of anhydrous potash K_2O. [2] Equivalent to 27 grains of KHO. [3 & 4] Absence of carbonate of potash. [5] Absence of lime. [6] A trace of sulphates. [7] A trace of chlorides. [8] A trace of alumina. A drop of sulphide of ammonium would turn the solution brown if lead were present.

Dose.—Ten minims up to one or two drachms, largely diluted in aromatic or bitter infusions, beer, milk, mistura amygdalæ, &c.

Antidotes.—Same as for caustic potash.

Concentrated liquor potassæ acts as a corrosive irritant poison, the symptoms and treatment resembling those of poisoning by caustic potash. Medicinally, liquor potassæ is used as an antacid, antilithic, lithontriptic, alterative, diuretic, liquefacient, resolvent, &c. It has been recommended in scrofula, phthisis, and other forms of tubercular disease; in syphilis; in acute and chronic rheumatism; in dyspepsia, accompanied by acidity, cardialgia, &c.; in a variety of skin diseases; in serous inflammations; in the latter stages of pneumonia; in chronic bronchitis and catarrh; in chronic affections of the liver and in jaundice; in bronchocele; in obesity; in certain calculous affections and irritable conditions of the urinary organs; in gonorrhœa and in strangury, &c. Externally, well diluted, it is employed as a lotion in chronic skin diseases, and occasionally as an escharotic, applied in the concentrated form to the bites of rabid and poisonous animals, &c.

Potassæ Carbonas (KO,CO_2 or K_2CO_3, with about 16 per cent. of water of crystallisation.) *Synonyms*: Carbonate of Potash—Carbonate de Potasse—Kolensäures Kali—1. *Impure*: Potassæ Carbonas Impura—Potassæ Subcarbonas Impura—Pot-ashes and Pearl-ashes of Commerce. 2. *Pure*: Kali Preparatum—Potassæ Carbonas Pura—Purified Pot-ashes and Pearl-ashes. 3. *According to its Source;* Vegetable Alkali—Wood-ash—Salt of Wormwood—Salt of Tartar—Fixed Nitre, &c.

The carbonates of potash of commerce are derived from the combustion of vegetable substances. The green and tender parts of plants yield the alkali in greater abundance than the older wood; herbs more than shrubs, and shrubs more so than trees. Potash does not exist in plants in the form of carbonate, but in combination with the radicles of various organic acids, in the form of tartrates, acetates, malates, oxalates, &c. During the combustion of the plants, these acids are destroyed, their carbon is converted by the oxygen of the atmosphere into carbonic acid in sufficient quantity to neutralise the potash, and the carbonate of potash thus prepared, not being decomposed by a red heat, remains when the process is completed. But the carbonate of potash in the ashes of plants is mixed with two sets of salts—the one, *insoluble* in water, consisting of carbonate and subphosphate of lime, alumina, silica, iron, manganese, &c.; the other *soluble*, consisting, in addition to the carbonate itself, of sulphate, phosphate, and silicate of potash, with the chlorides of potassium and sodium. By lixiviation the soluble salts are separated from the insoluble, and by evaporation in iron kettles are reduced to the consistency of sugar, and being then of a dark colour, they are termed *black salts*. This mass is next submitted to a high temperature, and if fused, it forms the *pot-ashes;* but if the carbon be burnt out of it, by permitting the flame of a reverberatory furnace to play over it, it constitutes the *pearl-ashes* of commerce. Pot-ashes are thus prepared in North America, Russia, Poland, Hungary, &c. But the carbonate of potash

thus obtained is far too impure for medicinal purposes. The pure carbonate of potash may be obtained in several ways:—1. By lixiviating and purifying the *pearl ashes* of commerce. 2. By passing carbonic acid into a solution of potash, evaporating the solution to dryness, and exposing the residue to a red heat. 3. By burning acid tartrate of potash, lixiviating the residue, and evaporating to dryness. 4. By throwing a mixture of acid tartrate of potash and nitrate of potash into a crucible heated to dull redness, lixiviating and evaporating. 5. By heating crystallised bicarbonate of potash nearly to redness, till its water of crystallisation and half its carbonic acid are driven off; by this process a pure carbonate is obtained.

CHARACTERS.—*A white crystalline powder, alkaline and caustic to the taste, very deliquescent, readily soluble in water, but insoluble in spirit, effervescing with diluted-hydrochloric acid, and forming a solution with which perchloride of platinum gives a yellow precipitate.*[1]

[1] Characteristic of potash, forming the double chloride of potassium and platinum, $2KCl,PtCl_4$, the potassio-perchloride of platinum, or platino-chloride of potassium. The dense solution formed by the deliquescence of the salt in air was formerly called *oil of tartar per deliquium.*

PURITY TESTS.—*Loses about sixteen per cent. of its weight when exposed to a red heat.*[1] *When super-saturated with nitric acid, and evaporated to dryness, the residue is almost entirely soluble in water, only a little silica remaining undissolved*[2]*; and the solution is precipitated only faintly by chloride of barium,*[3] *and nitrate of silver.*[4] *Eighty-three grains require for neutralisation at least* 980 *grain measures of the volumetric solution of oxalic acid.*[5] *Twenty grains of carbonate of potash neutralise* 17 *grains of citric acid, or* 18 *grains of tartaric acid.*

[1] Due to the expulsion of water. [2] Absence of insoluble salts, as of lime, &c. [3 & 4] Mere traces of sulphates and chlorides, which are common impurities. [5] Equivalent to forty-six grains of potash.

Dose.—Five or ten to twenty grains, sufficiently diluted; as a lotion, half a drachm to a drachm in a pint of water; as a bath, one to three ounces in twenty to thirty gallons of water; as an ointment, half a drachm to an ounce of simple ointment.

Carbonate of potash in over doses acts as a corrosive poison, the symptoms and treatment resembling those of poison by caustic potash. Medicinally it is an antacid, diuretic, alterative, and antilithic. It is less caustic than potash, and may therefore be administered more freely; but, in consequence of its disagreeable taste and irritant action, it is comparatively little used. It has been employed in cases similar to those for which the bicarbonate and solution of potash are recommended, and occasionally in the form of effervescing draughts. Combined with cochineal in solution, it has been recommended in hooping-cough. It passes into the urine unchanged. Externally, in the form of lotion, bath, or ointment, it has been used in skin diseases, more especially in the various forms of eczema.

Potassæ Bicarbonas ($KO,HO,2CO_2$, or $KHCO_3$). *Synonyms:* Bicarbonate of Potash—Hydropotassic Carbonate—Bicarbonate de Potasse—Doppelt Köhlensaures Kali—Aërated Kali.

Preparation.—*Take of carbonate of potash, 1 pound; distilled water, 2 pints; hydrochloric acid, 1½ pint; water, 3 pints; white marble in fragments, 1 pound, or a sufficiency. Dissolve the carbonate of potash in the distilled water, and filter the solution into a three-pint bottle, capable of being tightly closed by a cork traversed by a glass tube sufficiently long to pass to the bottom of the fluid. Introduce the marble into another bottle, in the bottom of which a few small holes have been drilled, and the mouth of which is closed by a cork also traversed by a glass tube, and place the bottle in a jar of the same height as itself, but of rather larger diameter. Connect the two glass tubes air-tight by a caoutchouc tube. The cork of the bottle containing the carbonate of potash having been placed loosely, and that of the bottle containing the marble tightly, in its mouth, pour into the jar surrounding the latter bottle the hydrochloric acid previously diluted with the water. When carbonic acid gas has passed through the potash solution for two minutes so as to expel the whole of the air of the apparatus, fix the cork tightly in the neck of the bottle, and let the process go on for a week. At the end of this time numerous crystals of bicarbonate of potash will have formed, which are to be removed, shaken with twice their bulk of cold distilled water, and, after decantation of the water, drained, and dried on filtering paper by exposure to the air. The mother liquor filtered if necessary, and concentrated to one-half, at a temperature not exceeding* 110°, *will yield more crystals.*

The tube immersed in the solution of carbonate of potash, which should have as large a diameter as possible, may require the occasional removal of the crystals formed within it, in order that the process may not be interrupted.

Rationale.—Carbonic acid is evolved from the marble ($CaCO_3 + 2HCl = CaCl_2 + H_2O + CO_2$), and is slowly absorbed by the carbonate of potash. Bicarbonate of potash is thus formed, which, being less soluble than the carbonate, crystallises out from the water—$K_2CO_3 + CO_2 + H_2O = 2KHCO_3$.

Characters.—*Colourless right rhombic prisms not deliquescent, of a saline feebly alkaline taste, not corrosive. Diluted hydrochloric acid causes strong effervescence, forming a solution with which perchloride of platinum gives a yellow precipitate.*[1]

[1] The potassio-perchloride of platinum, $2KCl,PtCl_4$, characteristic of potash. The bicarbonate is inodorous; when heated, loses half its carbonic acid and water and becomes the carbonate. It is soluble in its own weight of hot water, and in four times as much cold water. If deliquescence takes place, it is due to the presence of carbonate, which may also be detected by the addition of a solution of corrosive sublimate, which, with the bicarbonate, gives at first a white precipitate, or mere opalescence of bicarbonate of peroxide of mercury, becoming subsequently a brownish red basic carbonate, in consequence of the liberation of carbonic acid; but if the carbonate be present there will be at once a brownish or brick-red precipitate.

Purity Tests.—*Fifty grains exposed to a low red heat, leave thirty-four*

and a-half grains of a white residue, which require for exact saturation 500 *grain measures of the volumetric solution of oxalic acid. Twenty grains bicarbonate of potash neutralize* 14 *grains of citric acid, or* 15 *grains of tartaric acid.*

The water and one equivalent of carbonic acid of the bicarbonate are expelled, and thirty-four and a half grains of the carbonate remain; equivalent to twenty-three and a half grains of potash. It is seldom adulterated.

Dose.—Ten grains to half a drachm, sufficiently diluted; or in the form of effervescing draughts, in the proportion of twenty grains of the bicarbonate to fourteen grains of citric acid, or three fluid drachms and a-half of fresh lemon juice.

Bicarbonate of potash acts as an antacid, diuretic, alterative, and antilithic, it has none of the corrosive properties of potash and its carbonate. It is employed in dyspepsia with acidity of the stomach, cardialgia, most usually in combination with a bitter tonic infusion, as infusion of gentian, &c. Largely diluted, it is employed in the lithic acid cachexia to maintain uric acid in solution; also to allay irritability of the bladder and kidneys, and in such cases is commonly combined with pareira, bucchu, or uva ursi, in the alkaline treatment of acute and chronic rheumatism, and in cases similar to those for which potash and its carbonate are recommended. The bicarbonate and carbonate of potash and soda are found more suitable than the solutions of the caustic alkalies for prescribing along with vegetable solutions; as the latter are apt to be decomposed by continued contact with caustic alkali, while they may be kept for any length of time unaffected by the carbonates.

Liquor Potassæ Effervescens—Effervescing Solution of Potash. *Synonyms:* Aqua Potassæ Effervescens—Potash Water.

Preparation.—*Take of bicarbonate of potash,* 30 *grains; water,* 1 *pint. Dissolve the bicarbonate of potash in the water, and filter the solution; then pass into it as much pure washed carbonic acid gas, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of seven atmospheres. Keep the solution in bottles securely closed, to prevent the escape of the compressed gas.*

Characters.—*Effervesces strongly when the containing vessel is opened, carbonic acid gas escaping. The liquid is clear and sparkling, and has an agreeable acidulous taste.*

Purity Tests.—*Ten fluid ounces, after being boiled for five minutes, require for neutralisation* 150 *grain measures of the volumetric solution of oxalic acid.*[1] *Five fluid ounces evaporated to one-fifth, and twelve grains of tartaric acid added, yield a crystalline precipitate, which when dried weighs not less than twelve grains.*[2]

[1] Oxalate of potash is formed with separation of carbonic acid. This indicates the presence of 15 grains of the bicarbonate of potash. [2] This

precipitate is the acid tartrate of potash, 12 grains of which contain about 2·6 grains of potassium, which again correspond to the amount of potassium in $7\frac{1}{2}$ grains of the bicarbonate of potash.

The actions and uses of this preparation are the same as those of the bicarbonate. It is, however, a valuable addition to the pharmacopœia, inasmuch as it affords a fixed standard strength for effervescing solutions of potash, which vary much as obtained from different manufacturers.

Potassæ Sulphas (KO,SO_3 or K_2SO_4). *Synonyms:* Sulphate of Potash—Potassic Sulphate—Arcanum Duplicatum—Sulfate de Potasse—Schwefelsäures Kali.

CHARACTERS AND TESTS.—*In colourless hard six-sided prisms terminated by six-sided pyramids; decrepitates strongly when heated; sparingly soluble in water; insoluble in alcohol. The aqueous solution is neutral to test paper,*[1] *gives no precipitate with oxalate of ammonia,*[2] *but, acidulated with hydrochloric acid, it is precipitated white by chloride of barium,*[3] *and yellow by perchloride of platinum.*[4]

[1] Bisulphate, if present, would give an acid reaction. [2] Absence of lime. It is rarely adulterated. [3] Characteristic of a sulphate, forming sulphate of baryta. [4] Characteristic of potash, forming the double chloride of potassium and platinum, $2KCl,PtCL_4$. Sulphate of potash is inodorous, has a bitterish saline taste, is permanent in air, is soluble in twelve times its weight of cold and in four of boiling water, and is insoluble in alcohol. The crystals are very hard, and in consequence are employed in mediate pulverisation.

Dose.—Fifteen to fifty or sixty grains, or more, either dissolved in a considerable quantity of water, or as a powder, in combination with rhubarb, or with rhubarb and aloes in solution.

In large doses, sulphate of potash may act as an irritant poison, and has caused death in several instances. In France it has been used to procure abortion. Medicinally, it is used as a mild aperient in dyspeptic and hepatic cases; it is also employed to repress the secretion of milk after parturition. It enters into *Pulvis Ipecacuanhæ Compositus*, of which it forms 8 parts in 10 by weight. It is introduced simply for its property of aiding the pulverisation of the Ipecacuanha.

POTASSÆ SULPHAS CUM SULPHURE is prepared by mixing nitrate of potash and sulphur together in equal parts, and deflagrating the mixture by throwing it in successive portions into a red-hot crucible. It is usually powdered, but may be obtained in rhombic prismatic crystals of a greyish white colour. It emits the odour of sulphuretted hydrogen, and probably consists of sulphate and sulphite of potash. In doses of thirty to sixty grains it acts as a mild laxative, and has been recommended in dyspeptic, hepatic, and chronic cutaneous diseases.

Potassæ Bisulphas ($KO,HO,2SO_3$ or $KHSO_4$). *Synonyms:* Bisulphate of Potash—Hydropotassic Sulphate—Potassæ Supersulphas—Acid Sulphate of Potash—Sal Enixum—Bisulphate de Potasse—Doppelt Schwefelsäures Kali.

Bisulphate of potash, not quite pure, is the residual salt of the process for manufacturing nitric acid by the action of sulphuric acid upon nitrate of potash. From this it may be purified by dissolving it in boiling water, adding to the solution an excess of sulphuric acid, and then concentrating and crystallising. The bisulphate is met with either as a white crystalline powder, or in small flattened prisms of the oblique rhombic system. The salt is inodorous, of a strongly acid and bitter taste, is permanent in air, soluble in two parts of cold and half a part of boiling water, but alcohol, by abstracting one equivalent of acid, converts it into the neutral sulphate. The bisulphate is rarely used medicinally; in doses of thirty to sixty grains it acts as a mild cathartic, and subsequently has a slightly tonic effect. It is employed in the preparation of the sulphate.

Potassæ Nitras (KO,NO_5 or KNO_3). *Synonyms:* Nitrate of Potash—Potassic Nitrate—Kali Nitricum—Saltpetre—Sal Petræ—Nitre—Nitrum—Nitrate de Potasse—Salpetersäures Kali.

The nitrate of potash of commerce, purified if necessary, by crystallisation from solution in distilled water. The nitre or saltpetre of commerce is chiefly derived from certain districts in the East Indies. It is a natural production, and is met with either as an efflorescence upon the surface of the soil, or disseminated through its superficial stratum. It is separated by lixiviating the soil. Nitre is also prepared artificially in Europe by building up lime rubbish, ashes, and animal matters into heaps, and irrigating them with urine. At the end of about three years the heaps, nitre walls or nitre-beds as they are called, according to their construction, are lixiviated, and the nitre is obtained by crystallisation.

Characters.—*In white crystalline masses or fragments of striated six-sided prisms, colourless, of a peculiar cool saline taste. Thrown on the fire it deflagrates; warmed in a test tube with sulphuric acid and copper wire it evolves ruddy fumes.*[1] *Its solution acidulated with hydrochloric acid gives a yellow precipitate with per-chloride of platinum.*[2]

[1] Nitrous or hyponitric acid, N_2O_4, proving it to be a nitrate. [2] The potassio-perchloride of platinum, $2KCl,PtCl_4$, characteristic of potash. Nitrate of potash is soluble in water in direct proportions to the temperature of the water; at 32°, 100 parts of water will dissolve 13·2 of the salt; at 212°, the same quantity will dissolve 246 parts. Cold is generated during the solution. It is insoluble in pure alcohol. It is permanent in air; and although an anhydrous salt, it contains a little interstitial water, and therefore loses weight when powdered and dried. When heated to about 600° it fuses without decomposition, and when poured into moulds, and congealed by cooling, it forms *Sal prunella;* at a higher temperature it is decomposed into oxygen and hyponitrite of potash, and is finally reduced to caustic potash.

Purity Tests.—*Its solution is not affected by chloride of barium*[1] *or nitrate of silver.*[2]

Absence of [1]sulphate of potash and [2]chloride of potassium, which are the common impurities of the nitrate.

Dose.—Five to twenty grains and upwards. In the smaller doses of five or ten grains, it may be given either in the form of powder or made into a draught with water and syrup: in the larger doses of several drachms to an ounce or more in the twenty-four hours, it is given largely diluted in barley water or other beverage, as a drink; or in the form of nitre-whey.

Antidotes.—None. Remove the salt by emetics or stomach pump; demulcent drinks.

Nitrate of potash, in large doses, acts as an irritant poison, causing pain in the stomach and abdomen, with nausea, vomiting, and purging, followed by collapse; a feeling of cold referred to the spine, muscular tremors, convulsions, &c., have been observed. Medicinally, in the smaller doses, it acts as a refrigerant, diuretic, and diaphoretic, its effects being modified by the tendencies of the medicines with which it is combined, and the mode of its administration. As a refrigerant, it is most active when dissolved in a little water immediately before it is taken. It has been recommended in continued fevers and in inflammatory affections, with the object of subduing the preternatural heat and reducing the force of the circulation, according to those who consider it to be a sedative of the heart and vascular system, as well as a refrigerant. On account of these properties also, it is given to arrest internal hæmorrhages, as hæmoptysis, &c. It is also used to allay the irritability of the stomach in inflammatory dyspepsia. It has been recommended in affections of the genito-urinary system, as in menorrhagia and in amenorrhœa, in leucorrhœa, in gonorrhœa, and the incontinence of urine of children. As a diuretic, it is sometimes given in dropsies. In spasmodic asthma the fumes of nitrate of potash (arising from burning paper previously saturated with a solution of the salt, and dried) sometimes give relief. In acute rheumatism nitrate of potash is given in large doses, in some cases from an ounce to an ounce and a half in the twenty-four hours. As a gargle, it is occasionally used in incipient sore throat; and externally, in combination with sal ammoniac, it is used as a refrigerant lotion.

Potassæ Acetas ($KO,C_4H_3O_3$, or $KC_2H_3O_2$). *Synonyms:* Acetate of Potash—Potassic Acetate—Kalium Oxidatum Aceticum—Terra Foliata Tartari—Digestive or Febrifuge Salt of Sylvius—Acetate de Potasse—Essigsäures Kali.

Preparation.—*Take of carbonate of potash,* 20 *ounces; acetic acid,* 2 *pints, or a sufficiency. To the acetic acid, placed in a thin porcelain basin, add gradually the carbonate of potash, filter, acidulate, if necessary,*

with a few additional drops of the acid, and, having evaporated to dryness, raise the heat cautiously so as to liquefy the product. Allow the basin to cool, and when the salt has solidified, and while it is still warm, break it into fragments and put it into stoppered bottles.

Rationale. — $K_2CO_3 + 2HC_2H_3O_2 = 2KC_2H_3O_2 + H_2O + CO_2$, the carbonic acid being allowed to escape, whilst the acetate of potash is formed in solution.

CHARACTERS.—*White foliaceous satiny masses, very deliquescent, with a watery solution of which tartaric acid causes a crystalline precipitate,*[1] *sulphuric acid the disengagement of acetic acid,*[2] *and a dilute solution of perchloride of iron strikes a deep-red colour.*[3]

[1] Of acid tartrate of potash, characteristic of a potash salt. [2] Characteristic of an acetate. [3] Forming chloride of potassium and peracetate of iron ($Fe_2 6C_2H_3O_2$), the latter of which gives a deep red colour, and is not crystallisable. The acetate is soluble in an equal weight of water at 60°, and in twice its weight of alcohol; the solutions are at first neutral, but in the aqueous solution the acetate is readily converted into carbonate by exposure to the atmosphere. By heat it is fused and decomposed into carbonate of potash.

PURITY TESTS.—*Neutral to test paper,*[1] *entirely soluble in rectified spirit.*[2] *Its solution is unaffected by sulphide of ammonium.*[3]

[1] The presence of carbonate of potash would make it alkaline. [2] Carbonate of potash is insoluble in spirit. [3] Absence of metallic impurities. The acetate is not subject to wilful adulteration, but may contain carbonate or sulphate of potash, chloride of potassium, iron, lead, copper, &c., from faulty preparation.

Dose.—Ten to thirty grains as a diuretic, sufficiently diluted; in larger doses it acts as a cathartic, but is seldom used for that purpose.

Acetate of potash in moderate doses acts as a diuretic, and being converted into the carbonate whilst in the system, it renders the urine alkaline as well as more copious. It is chiefly used as a diuretic in dropsies; also in the alkaline treatment of acute rheumatism, in certain skin diseases, and in the uric acid diathesis. On the Continent it is employed as an alterative in chlorosis and in glandular enlargements.

Potassæ Chloras (KO,ClO_5, or $KClO_3$). *Synonyms:* Chlorate of Potash—Potassic Chlorate—Kalium Oxidatum Chloricum—Oxymuriate of Potash—Chlorate de Potasse—Chlorsäures Natron.

PREPARATION.—*Take of carbonate of potash* 20 *ounces; slaked lime,* 53 *ounces; distilled water, a sufficiency; black oxide of manganese,* 80 *ounces; hydrochloric acid,* 24 *pints. Mix the lime with the carbonate of potash, and triturate them with a few ounces of the water so as to make the mixture slightly moist. Place the oxide of manganese in a large retort or flask, and having poured upon it the hydrochloric acid, diluted with six pints of water, apply a gentle sand heat, and conduct the chlorine, as it comes over, first through a bottle containing six ounces of*

water, and then into a large carboy containing the mixture of carbonate of potash and slaked lime. When the whole of the chlorine has come over, remove the contents of the carboy, and boil them for twenty minutes with seven pints of the water; filter and evaporate till a film forms on the surface, and set aside to cool and crystallise. The crystals thus obtained are to be purified by dissolving them in three times their weight of boiling distilled water, and again allowing the solution to crystallise.

Rationale.—The carbonic acid passes from the potash to the lime, so that the carboy contains carbonate of lime and caustic potash—$K_2CO_3 + CaH_2O_2 = CaCO_3 + 2KHO$. The contents of the retort yield chlorine—$MnO_2 + 4HCl = MnCl_2 + 2H_2O + 2Cl$. Lastly, the chlorine, when passed into the mixture contained in the carboy, produces chloride of potassium and chlorate of potash—$6Cl + 3K_2O = 5KCl + KClO_3$. The carbonate of lime is separated by filtration, and the chloride of potassium remains in solution after the chlorate is removed by cystallisation.

CHARACTERS.—*In colourless rhomboidal crystalline plates, with a cool saline taste, sparingly soluble in cold water. It explodes when triturated with sulphur. By heat it fuses, gives off oxygen gas, and leaves a white residue, readily forming with water a neutral solution, which is precipitated white by nitrate of silver, and yellow by perchloride of platinum.*

By heating the salt its oxygen is driven off, and chloride of potassium remains, characterised as a chloride by giving a white precipitate with nitrate of silver, and as a salt of potash by giving the potassio-perchloride of platinum ($2KCl,PtCl_4$) with perchloride of platinum. The chlorate is soluble in eighteen parts of cold and two and a-half parts of boiling water, scarcely soluble in alcohol. The crystals are permanent in air.

PURITY TESTS.—*Its solution is not affected by nitrate of silver,*[1] *or oxalate of ammonia.*[2]

[1] Absence of chloride of potassium. [2] Absence of lime.

Dose.—Ten to thirty grains or more dissolved in water. For children, two to five grains in solution.

TROCHISCI POTASSÆ CHLORATIS—Chlorate of Potash Lozenges.

PREPARATION.—*Take of chlorate of potash, in powder,* 3600 *grains; refined sugar, in powder,* 25 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water* 1 *fluid ounce, or a sufficiency. Mix the powders, and add the mucilage and water to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains five grains of chlorate of potash.*

Dose.—One to six lozenges.

Chlorate of potash acts as a refrigerant and diuretic, and is given in febrile affections, either as a medicinal potion or made into a drink. It has been supposed capable of supplying oxygen to the system, and also the deficiency of the saline constituents of the blood in cholera and other diseases. With the view of giving oxy-

gen, it is used in cases of threatened asphyxia of the fœtus during the latter months of pregnancy, in consequence of diseased placenta. It has been recommended as a substitute for mercury in syphilis and in hepatic affections, and it has been observed to cause soreness of the gums. In cancrum oris, gangrenous stomatitis, aphthous and other ulcerations of the mouth, in diphtheria, cynanche, fetid breath, in scarlatina, &c., it is employed both internally and as a gargle or wash. As a lotion it is applied to a variety of painful and indolent ulcers, and as an injection in affections of the genito-urinary organs. It has also been recommended internally in many other diseases, including chronic bronchitis, phthisis, scrofula, scurvy, erysipelas, dropsies, to arrest salivation, chronic diarrhœa, &c. The lozenges are specially applicable for throat affections.

Potassæ Tartras Acida ($HO,KO,C_8H_4O_{10}$, or $KHC_4H_4O_6$). *Synonyms:* Acid Tartrate of Potash—Hydropotassic Tartrate—Potassæ Bitartras—Cream of Tartar—Tartar—Argol—Supertartrate of Potash—Tartrate Acide de Potasse—Doppelt—Weinsäures Kali.

An acid salt which is obtained from the crude tartar which is deposited during the fermentation of grape-juice.

Acid tartrate of potash, in an impure state, is obtained as a deposit from wine. It occurs in the juice of the fresh grape in a soluble form, but when the juice has undergone the vinous fermentation, its sugar being converted into alcohol, the salt is no longer soluble, and is deposited as "red argol" from red wines, and as "white argol" from white wines. In this state of crude tartar or argol it is met with in wine casks. It is purified by dissolving it in water with a small proportion of pipe-clay, which gradually subsides, carrying with it the colouring matter of the argol, and leaving the pure tartrate to crystallise upon the surface of the liquor and the sides of the vessel. Formerly, the term *cream of tartar* was restricted to that which forms upon the surface.

CHARACTERS.—*A gritty white powder, or fragments of cakes crystallised on one surface; of a pleasant acid taste, sparingly soluble in water, insoluble in spirit. Heated in a crucible, it evolves inflammable gas, and the odour of burned sugar, and leaves a black residue.*[1] *This effervesces with diluted hydrochloric acid, and forms a solution which, when filtered, gives a yellow precipitate with perchloride of platinum,*[2] *and when neutralised by ammonia is rendered slightly turbid by oxalic acid.*[3]

[1] The black residue consists of carbonate of potash with carbon. [2] The double chloride of potassium and platinum, $2KCl,PtCl_4$, characteristic of potash. [3] Showing that not more than a trace of tartrate of lime is present in the salt. The acid tartrate crystallises in rhombic prisms, is soluble in two hundred parts of cold water, and in eighteen parts at 212°, —the addition of boracic acid or borax renders it much more soluble.

Purity Tests.—188 *grains heated to redness till gas ceases to be evolved, leave an alkaline residue, which requires for exact neutralisation* 1000 *grain-measures of the volumetric solution of oxalic acid.*[1]

[1] The residue consists of carbonate of potash, equivalent to forty-seven grains of potash. It may be adulterated with salts of lime, iron, alumina, copper, flour, starch, &c., which may be detected by appropriate tests.

Dose.—Ten to sixty grains as a refrigerant and diuretic, and up to half-an-ounce as a cathartic, dissolved, or in the form of confection, or as a drink.

Acid tartrate of potash in over doses acts as an irritant poison; in the smaller doses it acts as a refrigerant and diuretic, and in the larger doses as a mild aperient, or as a hydragogue cathartic according to the quantity, acting more energetically when only partially dissolved or given in the form of confection. It is found in the urine in the form of carbonate, and renders it alkaline. It is given in fever and inflammatory diseases, in dropsical affections, in chronic affections of the liver; in combination with sulphur, as in the confection, it is given in hæmorrhoids, chronic dysentery, and diseases of the rectum; in albuminuria, chronic cardiac diseases, &c. It is a constituent of sulphur confection and of compound powder of Jalap.

Potassæ Tartras ($2\,KO,C_8H_4O_{10}$ or $K_2C_4H_4O_6$). *Synonyms:* Tartrate of Potash—Potassic Tartrate—Kalium Oxidatum Tartaricum Neutrale—Neutral Tartrate of Potash—Tartarus Tartarisatus—Kali Tartaricum—Soluble Tartar—Tartrate de Potasse—Einfach Weinsäures Kali.

Preparation.—*Take of acid tartrate of potash,* 20 *ounces, or a sufficiency; carbonate of potash,* 9 *ounces, or a sufficiency; boiling distilled water,* 2½ *pints. Dissolve the carbonate of potash in the water; add by degrees the acid tartrate of potash, and if, after a few minutes' boiling, the liquid is not neutral to test paper, make it so by the careful addition of more of the carbonate or of the acid tartrate. Then filter, concentrate till a pellicle forms on the surface, and set it aside to cool and crystallise. More crystals may be obtained by evaporating and cooling the mother liquor. Drain the crystals, dry them by exposure to the air in a warm place, and preserve them in a stoppered bottle.*

Rationale.—Tartaric acid is bibasic; in the acid tartrate of potash the base consists of one atom of potassium and one of hydrogen, and when this salt is neutralised by carbonate of potash, the potassium of the latter replaces the basic hydrogen of the former, carbonic acid being evolved—$2KHC_4H_4O_6 + K_2CO_3 = 2K_2C_4H_4O_6 + H_2O + CO_2$.

Characters.—*In small colourless four or six sided prisms. Heated with sulphuric acid it forms a black tarry fluid, evolving inflammable gas and the odour of burned sugar.*[1] *Acetic acid added sparingly to its solution causes the separation of a white crystalline precipitate.*[2]

[1] Characteristic of a tartrate. [2] The acetic acid removes one atom of potassium, which is replaced by an atom of basic hydrogen, thus forming the insoluble acid tartrate—$K_2C_4H_4O_6 + HC_2H_3O_2 = KC_2H_3O_2 + HKC_4H_4O_6$. The neutral tartrate is soluble in its own weight of water, and insoluble in alcohol. It is permanent in the air, but contracts a little moisture when exposed.

PURITY TESTS.—*Entirely dissolved by its own weight of water.*[1] 113 *grains, heated to redness till gases cease to be evolved, leave an alkaline residue, which requires for exact neutralisation* 1000 *grain-measures of the volumetric solution of oxalic acid.*[2]

[1] The acid tartrate and other less soluble impurities are thus detected. [2] The alkaline residue is carbonate of potash, equivalent to forty-seven grains of potash. It may contain tartrate of lime, and the acid tartrate or other salts of potash.

Dose.—As a diuretic, twenty to sixty grains; as a cathartic, in doses up to half-an-ounce, or more, dissolved in water or other vehicle, as infusion of senna, rhubarb, &c.

Tartrate of potash in small doses acts as a diuretic, and being converted into the carbonate in the system, tends to render the urine alkaline. In larger doses it is employed as a mild saline cathartic.

Potassæ Citras ($3KO,C_{12}H_5O_{11}$, or $K_3C_6H_5O_7$). *Synonyms:* Citrate of Potash — Potassic Citrate — Citrate de Potasse — Salt of Riverius.

PREPARATION.—*Take of carbonate of potash,* 8 *ounces, or a sufficiency; citric acid, in crystals,* 6 *ounces, or a sufficiency; distilled water,* 2 *pints. Dissolve the citric acid in the water, add the carbonate of potash gradually, and, if the solution be not neutral, make it so by the cautious addition of the acid or the carbonate of potash. Then filter, and evaporate to dryness, stirring constantly after a pellicle has begun to form, till the salt granulates. Triturate in a dry warm mortar, and preserve the powder in stoppered bottles.*

Rationale.—The carbonate of potash is decomposed, the carbonic acid being given off and water formed whilst the potassium unites with the citric acid in the proportion of three equivalents of the former to one of the latter, citric acid being tribasic—$3K_2CO_3 + 2H_3C_6H_5O_7 = 3CO_2 + 3H_2O + 2K_3C_6H_5O_7$.

CHARACTERS.—*A white powder of saline feebly acid taste, deliquescent, and very soluble in water. Heated with sulphuric acid it forms a brown fluid, gives off an inflammable gas, and evolves the odour of acetic acid.*[1] *Its solution, mixed with a solution of chloride of calcium, remains clear till it is boiled, when a white precipitate separates, readily soluble in acetic acid.*[2] *Its solution, acidulated with hydrochloric acid, gives a yellow precipitate with perchloride of platinum.*[3]

[1] The citric acid is decomposed, carburetted hydrogen, acetic acid, &c., being formed. [2] Citrate of lime is formed; but this being more soluble in cold than in hot water, is not precipitated until the mixture is

boiled. [3] Potassio-perchloride of platinum, $2KCl,PtCl_4$, characteristic of potash.

Purity Test.—102 *grains heated to redness till gases cease to be evolved leave an alkaline residue, which requires for exact neutralisation* 1000 *grain-measures of the volumetric solution of oxalic acid.*

Dose.—Ten to thirty grains or more dissolved in water and sweetened.

Citrate of potash acts as a diaphoretic, diuretic, and refrigerant; it does not affect the bowels so readily as the other neutral salts of potash. It is converted into the carbonate in the system, and tends to render the urine alkaline. It is employed in febrile and inflammatory diseases, in cases of irritability of the stomach, in uric acid gravel, in gout and rheumatism, in scurvy, &c.

POTASSÆ BICHROMAS ($KO,2CrO_3$ or $K_2Cr_2O_7$).—Bichromate of potash may be prepared by adding sulphuric acid to a solution of chromate of potash, and setting aside the mixture until the crystals are deposited.

Characters.—*In large red, transparent four-sided tables; anhydrous; fuses below redness; at a higher temperature is decomposed, yielding green oxide of chromium and yellow chromate of potash, which may be separated by dissolving the latter in water.*

Tests.—*The bichromate, dissolved in water, gives a yellowish white precipitate with chloride of barium, and a purplish red precipitate with nitrate of silver, and both these precipitates are soluble in diluted nitric acid.*[1] *The solution also, when digested with sulphuric acid and rectified spirit, acquires an emerald green colour.*[2]

[1] Characteristic of this salt, the precipitates being respectively the bichromate of barium, $BaCr_2O_7$, and bichromate of silver, $Ag_2Cr_2O_7$. [2] By this process the sesquioxide, Cr_2O_3, and sulphate of chromium, Cr_23SO_4, are formed; the latter yields the green colour.

This salt is used in the preparation of Valerianate of Soda, but is not much employed in medicine. In over-doses it acts as a powerful irritant poison. In doses of a tenth to a fifth of a grain it is used as an alterative in secondary syphilis; in larger doses of one or two grains it acts as an emetic, but is unsafe in consequence of its irritant properties. Externally it is used as a caustic either in the solid form or as a concentrated solution. Solutions of the bichromate act as antiseptics. Workmen employed in the manufacture of bichromate of potash are apt to suffer from painful ulcerations of the hands. It is largely manufactured for dyeing purposes.

POTASSII CYANIDUM (KC_2N, or KCN).—Cyanide of Potassium—Cyanuret of Potassium, or Hydrocyanate of Potassa—may be prepared by fusing together ferrocyanide of potassium and carbonate of potash until effervesence ceases; oxide of iron is precipitated, and the clear liquid being poured off from it concretes on cooling into a

white mass, which is to be kept in well-stoppered bottles. Thus prepared it is contaminated with cyanate and carbonate of potash; but by the addition of a small proportion of powdered charcoal previous to heating the ingredients, and afterwards digesting the fused mass in boiling alcohol, the cyanide may be obtained free from them. It may also be prepared by the action of hydrocyanic acid upon pure potash. Cyanide of potassium is exceedingly poisonous, has a pungent alkaline taste, and, when moistened by deliquescence, emits the odour of prussic acid. It is readily soluble in water, but scarcely soluble in alcohol. When quite pure the cyanide is of a milk-white colour, is free from moisture, is inodorous, and is completely soluble in water, forming a clear solution. As a poison, cyanide of potassium acts like hydrocyanic acid, the pure cyanide being equal to two-fifths of its weight of the acid, and the treatment is the same for both poisons. Medicinally, in doses of a tenth to a quarter of a grain, it might be used as a substitute for hydrocyanic acid, but in consequence of the difficulty of preserving it, and the uncertainty of the strength of the commercial varieties, it is not used internally. Externally, it has been applied both in the form of ointment and solution in neuralgic cases, in certain cutaneous affections, &c. The cyanide readily removes stains of nitrate of silver from the skin or from linen.

SODIUM ($Na = 23$).—*Sodium—Natrium*—is a soft, malleable, wax-like, and somewhat silver-like metal, which burns with a yellow flame, floats on water, and readily tarnishes by oxidation when exposed to the air. It exists largely throughout nature in the form of common *salt*, ($NaCl$), and is the metallic base of

Soda Caustica (NaO,HO, or $NaHO$). *Synonyms:* Sodæ Hydras—Natrium Oxidatum Hydraticum—Mineral Alkali—Hydrate of Soda—Hydrate of Sodium—Soude—Natron.

Preparation.—*Take of solution of soda, 2 pints. Boil down the solution of soda rapidly in a silver or clean iron vessel, until there remains a fluid of oily consistence, a drop of which, when removed on a warm glass rod, solidifies on cooling. Pour the fluid on a clean silver or iron plate, or into moulds, and, as soon as it has solidified, break it in pieces, and preserve it in stoppered green-glass bottles.*

Characters.—*Hard and greyish-white, very alkaline and corrosive. It imparts a yellow colour to flame, and its solution in water, acidulated by nitric acid, gives only scanty white precipitates with nitrate of silver*[1] *and chloride of barium.*[2]

Purity Tests.—*Forty grains dissolved in water leave scarcely any sediment, and require for neutralisation about 900 grain-measures of the volumetric solution of oxalic acid.*

Indicating the presence of mere traces of chlorides[1] and sulphates.[2] In the preparation of caustic soda, the solution must be boiled *rapidly*, otherwise the carbonate will be present. It acts upon the lead of white flint-glass bottles, and must therefore be kept in green-glass bottles.

Antidotes, doses, actions, and uses, same as caustic potash, than which it is less powerful, and less deliquescent; but it is chiefly used for chemical purposes.

Liquor Sodæ.—Solution of Soda.

Preparation.—*Take of carbonate of soda,* 28 *ounces; slaked lime,* 12 *ounces; distilled water,* 1 *gallon. Dissolve the carbonate of soda in the water; and, having heated the solution to the boiling point in a clean iron vessel, gradually mix with it the slaked lime, and continue the ebullition for ten minutes with constant stirring. Then remove the vessel from the fire; and, when by the subsidence of the insoluble matter the supernatant liquor has become perfectly clear, transfer it by means of a siphon to a green-glass bottle furnished with an air-tight stopper, and add distilled water, if necessary, to make it correspond with the tests of specific gravity and neutralising power.*

Rationale.—($Na_2CO_3 + CaH_2O_2 = CaCO_3 + 2NaHO$). Explanation similar to that given under liquor potassæ, which this solution resembles in its general properties, its chief characteristic being the yellow colour imparted by it to the blow-pipe flame; but it does not, like the potash solution, precipitate with tartaric acid, nor with perchloride of platinum.

Purity Tests. —*Specific gravity,* 1·047[1]·458 *grains by weight (one fluid ounce) require for neutralisation* 470 *grain-measures of the volumetric solution of oxalic acid,*[2] *corresponding to* 4·1 *per cent. by weight of hydrate of soda,* NaO,HO or NaHO. *It does not effervesce when added to an excess of diluted hydrochloric acid.*[3] *Mixed with an equal volume of distilled water, it gives no precipitate with solution of lime*[4] *or oxalate of ammonia.*[5] *When it is treated with an excess of diluted nitric acid, and evaporated to dryness, the residue forms with water a clear solution, which is only slightly precipitated by chloride of barium,*[6] *or by nitrate of silver,*[7] *and not at all by ammonia.*[8] *One fluid ounce contains* 18·8 *grains of hydrate of soda.*

[1] Equal to about four per cent. of anhydrous soda. [2] Equivalent to 14·57 grains of soda. [3 & 4] Absence of carbonate of soda. [5] Absence of lime. [6] A trace of sulphates. [7] A trace of chlorides. [8] Absence of silica, alumina, magnesia.

Antidotes, doses, actions, and uses, similar to those of liquor potassæ, than which it is somewhat weaker. It is employed in the preparation of caustic soda, valerianate of soda, and sulphurated antimony.

Sodæ Carbonas ($NaO,CO_2 + 10HO$, or $Na_2CO_3,10H_2O$.) *Synonyms:* Carbonate of Soda—Sodic Carbonate—Natron—Sodæ Subcarbonas—Carbonate de Soude—Kohlensäures Natron. In the impure state, Impure Carbonate or Barilla. In the purified state, Pure Carbonate or Natron Præparatum.

Obtained from the ashes of marine plants, or produced by chemical decomposition, with chloride of sodium.

Carbonate of soda was formerly derived chiefly from barilla and kelp, the former being the ashes of *salsola soda,* and other maritime plants, the latter being the ashes of sea-weeds. Native carbonate of soda was also imported from Egypt, where it occurs as an efflorescent crust upon the soil in certain localities; but it is now commonly obtained from Sea Salt. The chloride of sodium is first converted into *salt-cake,* which consists of

sulphate of soda; and this being heated with crushed chalk and small coal, is converted into what is termed *ball soda* or *black-ash*, from which the carbonate is derived by lixiviation and subsequent purification.

CHARACTERS.—*In transparent colourless laminar crystals of a rhombic shape, efflorescent, with a harsh alkaline taste and strong alkaline reaction. It imparts a yellow colour to flame, and dissolves with effervescence in diluted hydrochloric acid, forming a solution which does not precipitate with perchloride of platinum. By heat it undergoes aqueous fusion, and then dries up, losing sixty-three per cent. of its weight.*

PURITY TESTS.—*When supersaturated with nitric acid, it precipitates only slightly with chloride of barium*[1] *or nitrate of silver.*[2] *One hundred and forty-three grains require for neutralisation at least* 960 *grain-measures of the volumetric solution of oxalic acid.*[3] *Twenty grains carbonate of soda neutralise* 9·7 *grains of citric acid and* 10½ *grains of tartaric acid.*

Mere traces of [1] sulphates and [2] chlorides. [3] Equivalent to very nearly thirty grains of soda.

SODÆ CARBONAS EXSICCATA—DRIED CARBONATE OF SODA. —*Take of carbonate of soda,* 8 *ounces. Expose the carbonate of soda in a porcelain capsule to a rather strong sand heat until the liquid which first forms is converted into a dry cake; and, having rubbed this to powder, enclose it in a stoppered bottle.*

Antidotes, doses, actions, and uses, same as carbonate of potash. By some physicians, however, soda, and especially its carbonate, is believed to exert a specially beneficial alterative effect on mucous membranes, and on that account is prescribed in preference to potash in diseases involving those structures. Dried carbonate of soda is simply the previous carbonate, minus its water of crystallisation, so that fifty-three grains of the dried are equal to 143 grains of the common carbonate. It may be given in doses of five to fifteen grains in pill or powder.

SODÆ SESQUICARBONAS ($2NaO, 3CO_2, 4HO$, or $2Na_2CO_3 H_2CO_3 3H_2O$), is met with as a natural production in the north of Africa, Egypt, Hindostan, Hungary, South America, &c., under the names *Trona* and *Natron*. It is not used in medicine; and that preparation which the London Pharmacopœia described as sesquicarbonate was found to be invariably bicarbonate.

Sodæ Bicarbonas ($NaO,HO,2CO_2$, or $NaHCO_3$). *Synonyms:* Bicarbonate of Soda—Hydrosodic Carbonate—Bicarbonate de Soude—Zweifach Kohlensäures—Natron—Natron Oxidatum Bicarbonicum—Sesquicarbonate—Carbonate.

PREPARATION.—*Take of carbonate of soda,* 2 *pounds; dried carbonate of soda,* 3 *pounds; white marble, in fragments,* 4 *pounds; hydrochloric acid,* 1 *gallon; water,* 2 *gallons; distilled water, a sufficiency. Fill with the marble a tubulated glass bottle having a few small holes drilled in the bottom, connect the tubulure tightly by a bent tube and corks with*

an empty two-necked bottle, and connect this with another bottle filled with the carbonates of soda, well triturated together, and let the tube be long enough to reach the bottom of the bottle. Before fixing the cork in the bottle containing the carbonate of soda, partially immerse the bottle containing the marble in the hydrochloric acid previously diluted with the water, and placed in any convenient vessel. When the whole apparatus is filled with carbonic acid gas, fix in tightly the cork of the bottle containing the carbonate of soda, and let the action go on until the gas ceases to be absorbed. Pour upon the damp salt which is formed, half its weight of cold distilled water, and shake it occasionally during the course of half-an-hour, then drain the undissolved portion, and dry it by exposure to the air on filtering paper placed on porous bricks.

Rationale.—Carbonic acid is evolved from the marble ($CaCO_3 + 2HCl = CaCl_2 + H_2O + CO_2$), and is slowly absorbed by the carbonates of soda, which are put into the bottle dry, and not in solution, as in the preparation of the corresponding salt of potash. When the carbonate of soda absorbs the additional equivalent of carbonic acid to become the bicarbonate, it parts with most of its water of crystallisation, which produces the dampness of the salt; and it is found to be advantageous to regulate the quantity of water by using the above proportion of the *dried* carbonate. By agitating the damp salt with cold distilled water, the carbonate, which is more soluble than the bicarbonate, is removed.

CHARACTERS.—*In powder or small opaque irregular scales, white, of a saline not unpleasant taste. Imparts a yellow colour to flame.*[1] *Dissolves with much effervescence in diluted hydrochloric acid, forming a solution in which perchloride of platinum causes no precipitate.*[2] *A solution of the salt in cold water gives a white and not a coloured precipitate with solution of perchloride of mercury.*[3]

[1] Characteristic of soda salts. [2] Distinguishing it from the corresponding potash salt. [3] Proves the absence of carbonate of soda, which would give a coloured precipitate. The presence of the carbonate may further be detected by giving a precipitate with sulphate of magnesia, which the bicarbonate does not.

PURITY TESTS.—*When supersaturated with nitric acid its solution scarcely precipitates with chloride of barium*[1] *or nitrate of silver.*[2] *Eighty-four grains exposed to a red heat leave fifty-three of an alkaline residue, which requires for neutralisation* 1000 *grain measures of the volumetric solution of oxalic acid.*[3] *Twenty grains of bicarbonate of soda neutralise* 16·7 *grains of citric acid, or* 17·8 *grains of tartaric acid.*

Mere traces of[1] sulphates and[2] chlorides. [3] The residue is carbonate of soda, and is equivalent to 23 grains of soda.

Dose.—Ten grains to half-a-drachm, sufficiently diluted; or in the form of effervescing draughts in the proportion of twenty grains of the bicarbonate to eighteen grains of tartaric acid, seventeen grains of citric acid, or half-an-ounce of lemon juice. Externally, as a lotion or ointment.

Trochisci Sodæ Bicarbonatis—Bicarbonate of Soda Lozenges.

PREPARATION.—*Take of bicarbonate of soda in powder,* 3600 *grains; refined sugar in powder,* 25 *ounces; gum acacia in powder,* 1 *ounce;*

mucilage of gum acacia, 2 fluid ounces; distilled water, 1 fluid ounce. Mix the powders, and add the mucilage and water to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains 5 grains of bicarbonate of soda.

Dose.—One to six lozenges.

Liquor Sodæ Effervescens — Effervescing solution of Soda. *Synomym:* Aqua Sodæ Effervescens—Soda water.

PREPARATION.—*Take of bicarbonate of soda, 30 grains; water, 1 pint. Dissolve the bicarbonate of soda in the water, and filter the solution; then pass into it as much pure washed carbonic acid gas, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of seven atmospheres. Keep the solution in bottles securely closed, to prevent the escape of the compressed gas.*

CHARACTERS AND TESTS.—*Effervesces strongly when the containing vessel is opened, carbonic acid gas escaping. The liquid is clear and sparkling, and has an agreeable acidulous taste. Ten fluid ounces, after being boiled for five minutes, require for neutralisation 178 grain measures of the volumetric solution of oxalic acid.*[1]

[1] The quantity of the volumetric solution of oxalic acid necessary to neutralise fifteen grains of the bicarbonate.

It is given as a cooling antacid drink, and has all the actions of the bicarbonate of soda.

Bicarbonate of soda acts as an antacid and alterative, and is employed in dyspepsia, in acidity of the primæ viæ, in pyrosis, &c., for the same purposes as the corresponding salt of potash. As an antilithic, the potash salt is preferable, because urate of soda is much less soluble than urate of potash; and for the same reason the bicarbonate of soda is less eligible in gout and rheumatism. It has been recommended, dissolved in hot water, as a drink during the passage of gall stones; also to allay the vomiting of pregnancy and in albuminuria. Externally, it is applied to a variety of skin diseases, either in the form of lotion, baths, or ointment, and is also given internally for the same purpose. In the form of Soda Water and Alkaline Mineral Waters it is largely used, but when long continued, in any form, it interferes with the processes of digestion and assimilation, and is contra-indicated in all cases accompanied by deposition of phosphates in the urine.

Sodii Chloridum ($NaCl$). *Synonyms:* Chloride of Sodium—Sodium Chloride—Salt—Common Salt—Table-Salt—Sea-Salt—Rock-Salt—Muriate of Soda—Sal Marinum—Chlorure de Sodium—Chlor Natrium—Natrium Chloratum Depuratum.

Chloride of Sodium is largely distributed throughout nature, both in the solid form of fossil and in beds of rock, and in solution in the sea and in brine-springs. It is also met with in animal and vegetable tissues and

fluids. The salt of commerce is obtained either by evaporating brine-springs or sea-water, or by quarrying it from the rock-salt mines. In order to obtain the chloride in a pure state, the commercial varieties are frequently dissolved, washed, and recrystallised.

CHARACTERS AND TESTS.—*In small white crystalline grains, or transparent cubic crystals, free from moisture, has a purely saline taste, imparts a yellow colour to flame,*[1] *is soluble in water. The solution is not precipitated by perchloride of platinum,*[2] *but gives with nitrate of silver a white precipitate soluble in ammonia but insoluble in nitric acid.*[3]

[1] Characteristic of soda-salts. [2] Distinguishing it from a salt of potash. [3] Characteristic of the chloride. Chloride of sodium is insoluble in absolute alcohol, but soluble in proof spirit. When quite pure it is permanent in air, but is usually somewhat deliquescent from the presence of chlorides of magnesium and calcium.

Dose.—In doses of one or more tablespoonfuls, dissolved in water, it acts as an emetic and cathartic. In doses of half-an-ounce to an ounce, dissolved in a suitable fluid, it operates as a cathartic enema.

Chloride of sodium is essential as an adjunct to ordinary articles of diet; without it animal life cannot be sustained, and even its temporary withdrawal is followed by diseases. In small quantities it acts as an alterative and stimulant, rendering the food palatable, and improving the powers of digestion. In very large doses it acts as an irritant poison, causing inflammation of the alimentary mucous membrane; half a pound, taken as a cure for worms, caused the death of a young lady, and a pound, taken in a pint of ale, killed a man in twenty-four hours; but much smaller quantities, as one or two ounces, have caused alarming symptoms. Medicinally, salt is given as an anthelmintic, and is administered both by the stomach and by the rectum; it has been recommended in large and frequently repeated doses in cholera; it has been used to check hæmoptysis, and for the cure of phthisis. Formerly, it was applied as an antiseptic in the treatment of low fevers, and more recently in the treatment of intermittent fever. Externally, salt acts as a rubefacient and stimulant; in the form of sea-water baths it is employed as a discutient, tonic, and deobstruent, sometimes combined with the internal use of sea-water. A saturated solution of salt is used as a collyrium in chronic granular ophthalmia. Chloride of sodium is also used as an antidote in poisoning by nitrate of silver, and to cause the removal of leeches from the skin, or their death, when they have accidentally entered any of the orifices of the body.

Borax ($NaO,2BO_3+10HO$ or $Na_2B_4O_7,10H_2O$). *Synonyms:* Sodæ Biboras—Biborate of Soda—Borate of Soda—Borate de Soude—Boraxsaures Natron—Tincal—Sedative Salt. Borax was formerly chiefly

imported from India under the names of *Tincal* and *Crude Borax;* in this form it occurs as a natural production, by spontaneous evaporation, on the shores of certain lakes in Thibet; from this the refined borax was obtained either by calcination or by washing in an alkaline ley. It is now manufactured by saturating boracic acid, obtained from the lagoons of Tuscany, with carbonate of soda; the mixture is thrown in successive quantities upon the floor of a reverberatory furnace, and impurities are subsequently separated by lixiviation.

CHARACTERS.—*In transparent colourless crystals, sometimes slightly effloresced, with a weak alkaline reaction; insoluble in rectified spirit, soluble in water. A hot saturated solution, when acidulated with any of the mineral acids, lets fall, as it cools, a scaly crystalline deposit* (*boracic acid*) *the solution of which in spirit burns with a green flame.*

When borax is heated it looses its water of crystallisation, and forms the light, porous and friable *borax usta seu calcinata.* At a red heat it assumes a transparent glass-like appearance, and is called *glass of borax.* When the common, or *decahydrated,* borax is dissolved in boiling water in such quantity that the density of the solution is 1·26, and is allowed to cool slowly, crystals of *octahedral borax* ($NaHB_2O_4,2H_2O$) are deposited, when the solution passes through the temperatures from 174° to 145°; below this point the ordinary crystals are deposited.

PURITY TEST.—191 *grains dissolved in* 10 *fluid ounces of distilled water require for saturation* 1000 *grain measures of the volumetric solution of oxalic acid.*[1]

[1] Equivalent to thirty-one grains of soda.

MEL BORACIS.—*Borax Honey. Take of borax, in fine powder,* 64 *grains; clarified honey,* 1 *ounce. Mix.*

Dose.—Fifteen or twenty to thirty grains, dissolved in water. As a lotion or gargle, three or four drachms in eight ounces of water. The honey may be allowed to dissolve in the mouth, or be dissolved in water to make a wash or gargle.

Glycerinum Boracis—Glycerine of Borax.

PREPARATION.—*Take of borax in powder,* 1 *ounce; glycerine,* 4 *fluid ounces. Rub them together in a mortar until the borax is dissolved.*

This preparation may be used instead of mel boracis, and is besides very suitable for making a gargle in the strength of about one ounce to eight ounces of water.

Borax is said to act as an antacid, antilithic, diuretic, refrigerant, and emmenagogue, and topically as an astringent. It is chiefly used as an application to the mouth in cases of aphthous ulcerations, fissures of the tongue, and mercurial salivation. Externally, it is employed as an application to sore nipples, and to certain skin diseases, such as pityriasis versicolor, impetigo, psoriasis, eczema, acne, prurigo, &c.; also, dissolved in distilled vinegar, as an application to ringworm. As an injection, it is used in leucorrhœa and in gonorrhœa, and into the bladder as a solvent for calculi. It is

not much given internally, but has been employed as an emmenagogue, and to stimulate the uterus in cases of tedious labour and retention of the placenta. It has been criminally used to cause abortion, and has occasionally produced that effect when administered for other purposes. It is not much used as a diuretic, but has been recommended, in conjunction with other medicines of a similar tendency, in dropsies, and also as a diuretic and antilithic in cases of uric acid deposits.

Sodæ Sulphas (NaO,SO_3+10HO, or $\mathbf{Na_2SO_4, 10H_2O}$)—Sulphate of Soda. *Synonyms:* Sodic Sulphate—Glauber's Salt.

PREPARATION.—*May be obtained from the residue left in the manufacture of hydrochloric acid, by neutralising it with carbonate of soda, and crystallising from solution in water.*

Rationale.—Hydrochloric acid is prepared by adding sulphuric acid to common salt. Thus, $2NaCl+H_2SO_4=Na_2SO_4+2HCl$. The salt which remains is sulphate of soda, always along with some free sulphuric acid, to neutralise which the carbonate of soda is added, which forms sulphate of soda and carbonic acid, the latter escaping as formed. Thus, $Na_2CO_3 + H_2SO_4=Na_2SO_4+CO_2+H_2O$.

CHARACTERS.—*In transparent oblique prisms; has a salt and bitter taste; effloresces on exposure to the air; soluble in water, insoluble in spirit.*

TESTS.—*Exposed to heat in a porcelain crucible it loses* 55·9 *per cent. of water.*[1] *Heated with solution of potash no odour of ammonia is evolved, and no precipitate is formed. Imparts a yellow colour to flame.*[2] *Fifty grains of it dissolved in distilled water, and acidulated with hydrochloric acid, give, by the addition of chloride of barium, a white precipitate, which, when it has been washed and dried, weighs* 72·2 *grains.*[3]

[1] The percentage amount of water of crystallisation in the salt. [2] Characteristic of soda. [3] Amount of sulphate of barium which would be formed by the sulphuric acid contained in 50 grains of the salt.

Dose.—One-quarter to one ounce.

Sulphate of soda is a mild but efficient cooling laxative in medicinal doses. In very large doses, and sparingly diluted, it has been known to act as an irritant poison. It is used as a purgative, either alone or combined with other purgatives, and is especially suited for febrile cases, owing to its refrigerant properties; but the sulphate of magnesia is generally preferred to it on account of its taste being less bitter. Like the magnesian sulphate it may be used as an antidote for poisoning with lead and baryta.

Sodæ Phosphas ($2NaO,HO,PO_5+24HO$, or $Na_2HPO_4,12H_2O$). *Synonyms:* Phosphate of Soda—Phosphate of Sodium—Common Tribasic or Rhombic Phosphate of Soda—Tasteless Purging Salt—Phosphate de Soude—Phosphorsaures Natron.

PREPARATION.—*Take of bone-ash, in powder,* 10 *pounds; sulphuric*

acid, 56 fluid ounces; distilled water, 4½ gallons, or a sufficiency; carbonate of soda, 16 pounds, or a sufficiency. Place the bone-ash in a capacious earthenware or leaden vessel, pour on the sulphuric acid, and stir with a glass rod, until the whole powder is thoroughly moistened. After twenty-four hours, add gradually, and with constant stirring, a gallon of the water; digest for forty-eight hours, adding distilled water from time to time to replace what has evaporated. Add another gallon of the water, stirring diligently, digest for an hour, filter through calico, and wash what remains on the filter with successive portions of distilled water, till it has almost ceased to have an acid reaction. Concentrate the filtrate to a gallon, let it rest for twenty-four hours, and filter again. Heat the filtrate to near the boiling point, add the carbonate of soda previously dissolved in two gallons of the water, till it ceases to form a precipitate and the fluid has acquired a feeble alkaline reaction. Filter through calico, evaporate the clear liquor till a film forms on the surface, and set it aside to crystallise. More crystals will be obtained by evaporating the mother liquor, a little carbonate of soda being added if necessary to maintain its alkalinity. Dry the crystals rapidly and without heat on filtering paper placed on porous bricks, and preserve them in stoppered bottles.

Rationale.—The bone-ash consists chiefly of the common, tribasic, or insoluble phosphate of lime ($Ca_3P_2O_8$), together with some carbonate of lime ($CaCO_3$); when sulphuric acid and water are added to it, in the manner directed, carbonic acid is liberated, and two new salts of lime are formed, namely, the sulphate ($CaSO_4$), which is almost entirely deposited, and the superphosphate ($CaH_4P_2O_8$), which remains in solution. By the first filtration most of the sulphate of lime is removed, and there remains in the filtrate the superphosphate, with a little of the sulphate of lime; by the concentration and second filtration all the sulphate is removed, and the soluble superphosphate alone remains. By the action of the carbonate of soda (Na_2CO_3) upon the superphosphate of lime ($CaH_4P_2O_8$) carbonic acid is again liberated, a subphosphate of lime ($Ca_2H_2P_2O_8$) is precipitated, and phosphate of soda remains in solution: thus, $2(CaH_4P_2O_8) + 2Na_2CO_3 = 2CO_2 + 2H_2O + Ca_2H_2P_2O_8 + 2(Na_2HPO_4)$. The decomposition is facilitated by the previous heating. The subphosphate is removed by the last filtration. Heat would fuse the crystals.

CHARACTERS.—*In transparent colourless rhombic prisms, terminated by four converging planes, efflorescent, tasting like common salt. It imparts a yellow colour to flame.*[1] *Its solution has a faintly alkaline reaction, it gives a yellow precipitate with nitrate of silver,*[2] *the resulting fluid acquiring an acid reaction.*

[1] Characteristic of a soda salt. [2] The result is nitric acid, nitrate of soda, and yellow tribasic phosphate of silver (Ag_3PO_4), which, if pure, is entirely soluble, without effervescence, on the addition of diluted nitric acid. The salt is alkaline, and soluble in about four parts of cold water; the crystals fuse when moderately heated, and at a dull red heat the basic atom of water is expelled, leaving the *pyrophosphate,* which at that temperature is a clear glass-like mass, but becomes opaque on cooling.

PURITY TEST.—*Heated to dull redness it loses sixty-three per cent. of its weight, leaving a residue,*[1] *which, when dissolved in water, gives with chloride of barium a precipitate almost entirely soluble in diluted nitric acid.*[2]

[1] Anhydrous pyrophosphate of soda ($Na_4P_2O_7$), which gives a white precipitate with nitrate of silver. [2] Indicating the absence of sulphuric acid and sulphates, which would form insoluble sulphate of baryta.

Dose.—As a saline cathartic, half-an-ounce to an ounce or more, in solution, or as a substitute for common salt, in broth or soup. In smaller doses it is alterative and antilithic. A solution of phosphate of soda is placed amongst the tests of the pharmacopœia.

Phosphate of soda acts as a mild saline cathartic, producing thin watery stools, and being less offensive to the palate than the sulphates of soda or magnesia, it is suitable for children or delicate adults. When given in mutton, veal, or chicken broth, its taste is scarcely distinguishable from that of common salt. It is employed in cases of simple constipation; in the saline treatment of cholera; as a solvent of uric acid deposits; as a gentle aperient in diabetes; as a local application in gout, &c. As an alterative for children, it may well replace grey powder.

Sodæ Acetas ($NaO,C_4H_3O_3+6HO$, or $NaC_2H_3O_23H_2O$). *Synonyms:* Acetate of Soda—Sodium Acetate—Natrium Oxidatum Aceticum—Terra Foliata Mineralis—Acetate de Soude—Essigsaures Natron.

Acetate of soda may be prepared by the action of carbonate of soda upon acetic acid, or by saturating impure pyroligneous acid with chalk or slaked lime, and afterwards decomposing the acetate of lime by means of sulphate of soda.

CHARACTERS.—*In transparent colourless crystals, soluble in water, forming a solution neutral to test-paper.*

TEST.—*The solution, when dilute, is not precipitated by chloride of barium,*[1] *or nitrate of silver.*[2]

[1] Absence of potash. [2] Absence of chlorides.

Uses.—Acetate of soda is used as a test, and is employed in the preparation of glacial acetic acid and of phosphate of iron. Medicinally, it is scarcely ever used; its properties and doses are similar to those of acetate of potash.

Sodæ Citrotartras Effervescens—Effervescing Citrotartrate of Soda.

PREPARATION.—*Take of bicarbonate of soda in powder,* 17 *ounces; tartaric acid in powder,* 8 *ounces; citric acid in powder,* 6 *ounces. Mix the powders thoroughly, place them in a dish or pan of suitable form, heated to between* 200° *and* 220°, *and when the particles of the powder begin to aggregate, stir them assiduously until they assume a granular form; then, by means of suitable sieves, separate the granules of uniform and most convenient size, and preserve the preparation in well-closed bottles.*

Rationale.—The bicarbonate of soda, the citric and tartaric acids, are intimately mixed by heating and stirring without uniting chemically.

Dose.—Sixty grains to half-an-ounce.

The granular form is especially convenient, as it allows the water to act gradually upon the salt, and thus moderates the rapidity of effervescence. The preparation is apt to absorb water from the air, whereby its constituents combine chemically, forming the citrate and tartrate of soda; hence the necessity of keeping it in stoppered bottles.

It is an exceedingly agreeable antacid effervescent refrigerant drink in teaspoonful doses. A teaspoonful may be put into a tumbler, about two-thirds full of water, mixed with a little sugar. It should be taken while the effervescence is going on. In doses of from two drachms to half-an-ounce it is a mild saline purgative, superior to the popular medicine known by the name of the granulated effervescing citrate of magnesia, which usually contains a considerable amount of sulphate of magnesia.

Soda Tartarata ($NaO,KO,C_8H_4O_{10}+8HO$, or $NaKC_4H_4O_6 4H_2O$). *Synonyms:* Sodæ et Potassæ Tartras—Tartrate of Soda and Potash—Sodæ Potassio-Tartras—Soda Tartarizata—Sel de Seignette—Rochelle Salt—Tartrate de Potasse et de Soude—Weinsaures Natron Kali.

Preparation.—*Take of acid tartrate of potash, in powder,* 16 *ounces, or a sufficiency; carbonate of soda,* 12 *ounces, or a sufficiency; boiling distilled water,* 4 *pints. Dissolve the carbonate of soda in the water, add gradually the acid tartrate of potash, and if, after being boiled for a few minutes, the liquid has an acid or alkaline reaction, add a little carbonate of soda or acid tartrate of potash, till a neutral solution is obtained. Boil and filter; concentrate the liquor till a pellicle forms on the surface, and set it aside to crystallise. More crystals may be obtained by again evaporating as before.*

Rationale.—The ingredients react upon each other, carbonic acid being evolved, and the atom of basic hydrogen in the acid tartrate of potash being replaced by the sodium of the carbonate of soda, thus, $2(HKC_4H_4O_6) + Na_2CO_3 = CO_2 + H_2O + 2(NaKC_4H_4O_6)$.

Characters.—*In colourless transparent prisms or halves of prisms of the right rhombic order, generally eight-sided; tasting like common salt. Heated with sulphuric acid, it blackens, evolving inflammable gases and the odour of burnt sugar.*[1] *It imparts a yellow colour to flame.*[2] *A strong solution gives a crystalline precipitate with a small quantity of acetic acid.*[3]

Purity Tests.—*Entirely soluble in cold water.* 141 *grains heated to redness till gases cease to be evolved leave an alkaline residue which requires for neutralisation* 1000 *grain-measures of the volumetric solution of oxalic acid.*

[1] Characteristic of a tartrate. [2] Characteristic of a soda salt. [3] Characteristic of a potash salt; the acetic acid removes the sodium as acetate, and supplies in its place the atom of basic hydrogen necessary to the formation of cream of tartar ($KHC_4H_4O_6$). The salt is inodorous, has a saline taste, is soluble in water, the solution being neutral; it is per-

manent in air, or slightly efflorescent, and fuses at a moderate heat. It is not subject to adulteration.

Dose.—From thirty grains to half-an-ounce, well diluted. It is the active ingredient of Seidlitz powders, each of which contains 120 grains of the salt, with 40 grains of bicarbonate of soda in the blue paper, and 30 grains of tartaric acid in the white.

Tartrate of soda and potash in small doses acts as a diuretic, and renders the urine alkaline. In the larger doses it acts as a mild saline cathartic. It is cooling, and therefore a suitable aperient in febrile and inflammatory states; and as an antilithic it is useful in uric acid deposits; it is given also in gout and rheumatism.

Sodæ Nitras—Nitrate of Soda—A native salt purified by crystallisation from water.

CHARACTERS.—*In colourless obtuse rhombohedral crystals, having a cooling saline taste. Thrown on the fire, it deflagrates.*

TESTS.—*Warmed in a test-tube, with sulphuric acid and copper wire, it evolves ruddy fumes.*[1] *It is soluble in about two parts of cold distilled water. The solution gives no precipitate with nitrate of silver,*[2] *or chloride of barium.*[3]

[1] Evidence of nitric acid. [2] Absence of chlorides. [3] Absence of sulphates.

It is only used to prepare the arseniate of soda.

Sodæ Valerianas ($NaO,C_{10}H_9O_3$, or $NaC_5H_9O_2$)—Valerianate of Soda.

PREPARATION.—*Take of amylic alcohol (fousel oil),* 4 *fluid ounces; bichromate of potash,* 9 *ounces; sulphuric acid,* $6\frac{1}{2}$ *fluid ounces; solution of soda, a sufficiency; distilled water,* $\frac{1}{2}$ *gallon. Dilute the sulphuric acid with* 10 *fluid ounces of the water, and dissolve the bichromate of potash in the remainder of the water with the aid of heat. When both liquids are cold, mix them with the fousel oil in a matrass, with occasional brisk agitation, until the temperature of the mixture has fallen to about* 90°. *Connect the matrass with a condenser, and distil until about half-a-gallon of liquid has passed over. Saturate the distilled liquid accurately with the solution of soda, remove any oil which floats on the surface, evaporate till watery vapour ceases to escape, and then raise the heat cautiously so as to liquefy the salt. When the product has cooled and solidified, break it into pieces, and immediately put it into a stoppered bottle.*

Rationale.—When the bichromate of potash and sulphuric acid are treated as directed, *chrome alum*, water, and oxygen are produced, thus, ($K_2Cr_2O_7 + 4H_2SO_4 = 2KCr(SO_4)_2 + 4H_2O + 3O$): so far the object of the process is to produce oxygen. Then, fousel oil (oil of potato spirit, or amylic alcohol) is the *hydrated oxide of amyle* (C_5H_{11}), and consists of $C_5H_{12}O$, which, by the removal of two equivalents of hydrogen and the addition of one equivalent of oxygen, provided by the first part of the process, is converted into valerianic acid ($HC_5H_9O_2$): thus, $C_5H_{12}O + 2O = HC_5H_9O_2 + H_2O$. Lastly, the valerianic acid thus prepared (which is accompanied

in the distillate by valerianate of amyle—$C_5H_{11}\cdot C_5H_9O_2$—afterwards removed as oil floating upon the surface) is saturated with the solution of soda to form the valerianate.

Characters.—*In dry white masses without alkaline reaction, entirely soluble in rectified spirit, and giving out a powerful odour of valerian on the addition of diluted sulphuric acid.*

Valerianate of soda is employed in the preparation of the valerianates. It is not itself used medicinally, but might be given in doses of half-a-grain to two or three grains, in cases in which the use of valerianic acid is indicated.

LITHIUM (L=7) obtains its name from λίθος, *a stone*, and from the fact that it was at first believed to belong only to the mineral kingdom; but, though sparingly, it is widely distributed. It is a white or reddish-white metal, of a hardness between that of potassium and lead, is capable of being welded by pressure at ordinary temperatures, and of being pressed into wire. It is the lightest of known solid substances (sp. gr. 0·5936), burns in air with a brilliant bright light, forming its only oxide, lithia.

Lithia (L_2O) is obtained chiefly from the minerals *lepidolite, triphane,* and *petalite;* it is met with also in fire-clay, in many micas and felspars, in the ash of tobacco, in the water of the Thames, in several mineral springs, &c. *Hydrate of lithia* (LHO), when exposed to the air, is not deliquescent, but absorbs carbonic acid, and becomes opaque; its solution has a strongly alkaline reaction and an acrid taste. It is soluble in water, though less so than potash or soda; and is but sparingly soluble in alcohol. It readily fuses below a red heat, and at a high temperature corrodes platinum, which affords a characteristic indication of its presence. It may be prepared in silver vessels. It may be distinguished from potassa by not precipitating with perchloride of platinum, and from sodium by imparting a crimson red instead of a yellow colour to the blow-pipe flame.

Lithiæ Carbonas (LO,CO_2, or L_2CO_3)—Carbonate of Lithia—may be prepared by adding a strong solution of carbonate of ammonia to a concentrated solution of the sulphate of lithia, and heating the mixture, from which the carbonate separates as a white deposit, which may be crystallised by cooling from a solution in water.

Characters.—*In white powder or in minute crystalline grains, alkaline in reaction, soluble in* 100 *parts of cold water, insoluble in alcohol. It dissolves with effervescence in hydrochloric acid; and the solution evaporated to dryness leaves a residue of chloride of lithium, which communicates a red colour to the flame of a spirit-lamp,*[1] *and redissolved in water, yields a precipitate with phosphate of soda.*[2]

[1] Chief test for lithia. [2] Producing tribasic phosphate of lithia (L_3PO_4), whereby it is distinguishable from the corresponding potash and soda salts.

Purity Tests.— *Ten grains of the salt neutralised with sulphuric acid, and afterwards heated to redness, leave* 14·86 *grains of dry sulphate of*

lithia, which, when redissolved in distilled water, yields no precipitate with oxalate of ammonia[1] *or solution of lime.*[2]

[1] Absence of lime. [2] Absence of magnesia and alumina.

Dose.—Two to six grains, in solution, well diluted; or in the form of *lithia water*, the carbonate being readily soluble in carbonic acid water.

LIQUOR LITHIÆ EFFERVESCENS—Effervescing Solution of Lithia. *Synonym:* Aqua Lithiæ Effervescens—Lithia Water.

PREPARATION.—*Take of carbonate of lithia,* 10 *grains; water,* 1 *pint. Mix in a suitable apparatus, and pass into it as much pure washed carbonic acid gas, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of seven atmospheres. Keep the solution in bottles securely closed, to prevent the escape of the compressed gas.*

CHARACTERS AND TESTS.—*Effervesces strongly when the containing vessel is opened, carbonic acid gas escaping. The liquid is clear and sparkling, and has an agreeable acidulous taste. Half a pint of it, evaporated to dryness, yields five grains of a white solid residue, answering to the tests for carbonate of lithia.*

Dose.—Five to ten fluid ounces.

This preparation has been made officinal chiefly to ensure a standard strength, and is simply a pleasant mode of administering the carbonate of lithia.

Carbonate of lithia acts as an alkaline, antilithic, lithontriptic, and diuretic. In consequence of its low combining proportion, it neutralises more acid than an equal quantity of the corresponding salts of potash and soda; and it has, therefore, been recommended as a superior remedy in the treatment of the uric acid and gouty diatheses; and not only because of its stronger affinity for uric acid, but also because urate of lithia is exceedingly soluble.

Lithiæ Citras ($3LO,C_{12}H_5O_{11}$, or $L_3C_6H_5O_7$)—Citrate of Lithia.

PREPARATION.—*Take of carbonate of lithia,* 50 *grains; citric acid in crystals,* 90 *grains; warm distilled water,* 1 *fluid ounce. Dissolve the citric acid in the water, and add the carbonate of lithia in successive portions, applying heat until effervescence ceases, and a perfect solution is obtained. Evaporate by a steam or sand bath till water ceases to escape, and the residue is converted into a viscid liquid. This should be dried in an oven or air-chamber at the temperature of about* 240°, *then rapidly pulverised, and enclosed in a stoppered bottle.*

Rationale.—The carbonic acid of the carbonate is liberated, and the citric acid (which, being a tribasic acid, assumes three equivalents of lithia) takes its place: thus, $3L_2CO_3 + 2H_3C_6H_5O_7 = 2L_3C_6H_5O_7 + 3CO_2 + 3H_2O$.

CHARACTERS.—*A white amorphous powder, deliquescent, and soluble in water without leaving any residue. Heated to redness it blackens, evolving inflammable gases; and the residue, neutralised by hydrochloric acid, yields with rectified spirit a solution which burns with a crimson flame.*[1]

PURITY TEST.—*Twenty grains of the salt, burned at a low red heat with free access of air, leave* 10·6 *grains of white residue.*[2]

[1] Characteristic of a lithia salt. [2] Carbonate of lithia.

Actions and uses same as the carbonate, than which it is much more soluble, and unlike which, it is deliquescent. It is converted into the carbonate in the system. It may be given in somewhat larger doses than the carbonate.

AMMONIA ($NH_3=17$). *Synonyms:* Volatile Alkali—Spiritus Volatilis Causticus—Hydrogène Azoté—Ammoniaque—Ammoniak. Of the compounds of nitrogen and hydrogen, ammonia is the only one that has been isolated; but there are two hypothetical compounds, namely, *Amidogen* (NH_2) and *Ammonium* (NH_4), the latter of which is regarded as a metal, although it cannot be obtained separately.

Ammonia—so called from the temple of Jupiter Ammon, in Lybia, near which sal ammoniac was formerly prepared—exists, in the form of one of its salts, in small quantity in the atmosphere, in the juices of certain plants, in certain mineral springs, &c., and is formed in large quantity during the putrefaction of animal matter. It may be prepared by gently heating in a small retort equal parts of chloride of ammonium and quicklime; thus, $2NH_4Cl + CaO = CaCl_2 + 2NH_3 + H_2O$. As thus obtained, it is a transparent, colourless, gaseous compound, capable of being liquefied either by a very low temperature or by great pressure. It has a pungent suffocating odour, powerfully irritates the mucous membrane, and is irrespirable. When moistened, it reacts as an alkali, but only transiently, and substances so affected by it return to their previous state after the ammonia has passed off; thus it differs from the fixed alkalies, and hence its name, volatile alkali. Its specific gravity is 0·59; it burns feebly, but does not support combustion. It is readily absorbed by water, which at a temperature of 50° takes up 670 times its volume of ammonia. It is soluble also in alcohol and ether. The density of the aqueous solution diminishes as the quantity of ammonia absorbed increases; thus 100 parts of a solution containing 9·50 of ammonia will have a specific gravity of ·9692, whereas 100 parts of a saturated solution containing 32·50 of ammonia will have a specific gravity of 0·891, water being 1·000. Gaseous ammonia may be recognised by its odour and by its transient reaction, also by the dense white fumes of chloride of ammonium, produced by exposing to its influence a glass rod dipped in hydrochloric acid.

Liquor Ammoniæ Fortior—Aqua Ammoniæ Fortior—Strong Solution of Ammonia—Ammoniacum Causticum Aquosum—Ammoniacal gas, NH_3, dissolved in water, and constituting 32·5 per cent. of the solution.

PREPARATION.—*Take of chloride of ammonium, in coarse powder,* 3 *pounds; slaked lime,* 4 *pounds; distilled water,* 32 *fluid ounces. Mix the lime with the chloride of ammonium, and introduce the mixture into an iron bottle placed in a metal pot surrounded by sand. Connect the iron tube, which screws air-tight into the bottle in the usual manner by corks, glass tubes, and caoutchouc collars, with a Woulf's bottle capable of holding a*

pint; connect this with a second Woulf's bottle of the same size, the second bottle with a matrass of the capacity of three pints, in which twenty-two ounces of the distilled water are placed, and the matrass, by means of a tube bent twice at right angles, with an ordinary bottle containing the remaining ten ounces of distilled water. Bottles one and two are empty, and the latter and the matrass which contains the twenty-two ounces of distilled water are furnished each with a siphon safety-tube charged with a very short column of mercury. The heat of a fire, which should be very gradually raised, is now to be applied to the metal pot, and continued until bubbles of condensible gas cease to escape from the extremity of the glass tube which dips into the water of the matrass. The process being terminated, the matrass will contain about forty-three fluid-ounces of strong solution of ammonia.

Bottles one and two will now include, the first about sixteen, the second about ten fluid ounces of a coloured ammoniacal liquid. Place this in a flask closed by a cork, which should be perforated by a siphon safety-tube containing a little mercury, and also by a second tube bent twice at right angles, and made to pass to the bottom of the terminal bottle used in the preceding process. Apply heat to the flask until the coloured liquid it contains is reduced to three-fourths of its original bulk. The product now contained in the terminal bottle will be nearly of the strength of solution of ammonia, and may be made exactly so by the addition of the proper quantity of distilled water, or of strong solution of ammonia.

Rationale.—$2NH_4Cl + CaH_2O_2 = CaCl_2 + 2H_2O + 2NH_3$.

CHARACTERS.—*A colourless liquid, with a characteristic and very pungent odour, and strong alkaline reaction.*

Perchloride of platinum gives a pale yellow precipitate of ammonio-perchloride of platinum $2NH_4Cl, PtCl_4$ which is insoluble in alcohol. Tartaric acid, when added in large proportion, gives a white precipitate of acid tartrate of ammonia $NH_4HC_4H_4O_6$.

PURITY TESTS.—*Specific gravity,* 0·891.[1] 52·3 *grains by weight require for neutralisation* 1000 *grain-measures of the volumetric solution of oxalic acid. One fluid drachm contains* 15·83 *grains of ammonia* (NH_3). *When diluted with four times its volume of distilled water, it does not give precipitates with solution of lime,*[2] *oxalate of ammonia,*[3] *sulphide*[4] *of ammonium, or ammonio-sulphate of copper;*[5] *and when treated with an excess of nitric acid, is not rendered turbid by nitrate of silver,*[6] *or by chloride of barium.*[7]

[1] The specific gravity increases as the strength of the solution diminishes. [2] Absence of carbonate of ammonia, a common impurity produced by the carbonic acid of the atmosphere. [3] Absence of lime. [4] Absence of oxide of copper. [5] Absence of sulphide of ammonium. [6] Absence of chlorides. [7] Absence of sulphates. Commercial solution of ammonia, prepared from gas-liquor, is apt to contain tarry impurities, of which one called *pyrrol* (which is not unfrequently present, and is highly prejudicial) may be detected by giving a red colour on the addition of pure nitric or sulphuric acid.

LIQUOR AMMONIÆ—SOLUTION OF AMMONIA.—*Take of strong solution of ammonia,* 1 *pint; distilled water,* 2 *pints. Mix and preserve in a stoppered bottle.*

TESTS.—*Specific gravity,* 0·959. 85 *grains by weight require for neutralisation* 500 *grain measures of the volumetric solution of oxalic acid, corresponding to* 10 *per cent. by weight of ammonia. One fluid drachm contains* 5·2 *grains of ammonia.*

LINIMENTUM AMMONIÆ—LINIMENT OF AMMONIA.—*Take of solution of ammonia,* 1 *fluid ounce; olive oil,* 3 *fluid ounces. Mix together with agitation.*

A rubefacient and stimulant application used as a counter-irritant.

Dose.—Of liquor ammoniæ (liquor ammoniæ fortior is not used internally), ten to thirty minims, sufficiently diluted.

Antidotes.—Vegetable acids; vinegar; inhalation of the vapour of hot vinegar; lemon or orange juice; mucilaginous drinks; subsequent antiphlogistic treatment, according to circumstances.

Gaseous ammonia, in the undiluted state, is irrespirable, causing spasm of the glottis and asphyxia; when somewhat diluted with atmospheric air, it acts as a violent irritant of the respiratory mucous membrane, and is capable of causing death by producing inflammation of the air passages. Strong solution of ammonia also acts as a violent irritant and corrosive poison, causing intense burning pain in the mouth, pharynx, œsophagus, and stomach, great difficulty in swallowing, sense of suffocation, and pain in the respiratory organs. Sometimes there is vomiting and purging, &c. Poisoning by ammonia and its carbonate resembles that by the caustic alkalies, potash and soda and their carbonates; but in consequence of its volatility the air-passages are always seriously implicated in the ammonia cases. Great care should be taken when ammonia is employed as a restorative, in cases where the patient is insensible, that the vapour or solution be sufficiently diluted; otherwise dangerous results may ensue. Externally, ammonia acts also as a powerful local irritant, producing rubefaction, vesication, or cauterisation, according to the strength and length of time of the application. Medicinally, ammonia is employed as a diffusable stimulant and restorative, antacid, antispasmodic, diaphoretic, sudorific, expectorant, antidote, counter-irritant, vesicant, &c. It has been recommended in the later stages of febrile and inflammatory diseases, and in other cases where there is great nervous prostration; also to hasten the cold stage of intermittent fever, and to promote the eruption in febrile exanthemata; in the later stages of pneumonia, and in chronic bronchitis; in atonic dyspepsia, with acidity of the primæ viæ, and flatulence; in syncope; in spasms; to avert fits of epilepsy; in hysteria; in amenorrhœa and chlorosis; to dissipate the effects of alcohol; in delirium tremens; as an antidote to seda-

tive poisons, such as hydrocyanic acid, digitalis, &c. Externally, it is employed as a counter-irritant in chronic pulmonary affections, in tic-douloureux and other neuralgic affections; it is used also as an adjunct to stimulating embrocations, to be applied to sprains, rheumatic pains, stiff joints, sore throat, ringworm, alopœcia, &c. As an antidote to the bites of serpents and venomous insects it is both locally applied and given internally. As a vesicant, it may be employed when prompt vesication is demanded, and in cases, especially affections of the urinary organs, in which cantharides is contra-indicated.

SPIRITUS AMMONIÆ FŒTIDUS—Fetid Spirit of Ammonia.—*Take of assafœtida,* 1½ *ounce; strong solution of ammonia,* 2 *fluid ounces; rectified spirit, a sufficiency. Break the assafœtida into small pieces and macerate it, in a closed vessel, in* 15 *fluid ounces of the spirit for twenty-four hours, then distil off the spirit, mix the product with the solution of ammonia, and add sufficient rectified spirit to make* 1 *pint.*

Dose.—One half to one fluid drachm.

This preparation is intended to combine the stimulant and antispasmodic effects of the ammonia and assafœtida. It is suitable for cases of hysteria, but its disagreeable taste and odour form serious objections to its use. It is a colourless, pungent, and fetid liquor, and was formerly officinal in the Pharmacopœias of London, Edinburgh, and Dublin. It may be readily replaced by a mixture of tincture of assafœtida and spirit of ammonia.

Ammoniæ Carbonas. *Synonyms:* Carbonate of Ammonia—Carbonate of Ammonium—Ammoniæ Sesquicarbonas—Sesquicarbonate of Ammonia, $2\,NH_4O,3CO_2$, or $N_4H_{16}C_3O_8$—Sal Volatile—Smelling Salts—Baker's Salt—Ammonia Præparata—Salt of Hartshorn—Sal Cornu Cervi Volatilis. A volatile, pungent, ammoniacal salt, produced by submitting a mixture of sulphate of ammonia, or chloride of ammonium, and carbonate of lime to sublimation.

The following is a representation in symbols of the reactions which take place:—

(1.) By cautiously subliming a mixture of powdered chloride of ammonium and carbonate of lime—

$$6NH_4Cl + 3CaCO_3 = (NH_4)_4C_3O_8 + 3CaCl_2 + 2NH_3 + H_2O.$$

(2.) By subliming a mixture of sulphate of ammonia and carbonate of lime—

$$3(NH_4)_2SO_4 + 3CaCO_3 = (NH_4)_4C_3O_8 + 3CaSO_4 + 2NH_3 + H_2O.$$

Characters.—*In translucent crystalline masses, with a strong ammoniacal odour, and alkaline reaction; soluble in cold water, more sparingly in spirit, and readily dissolved by acids with effervesence.*

When exposed to the air it loses in a great measure its pungent

odour; is no longer translucent, but covered with a white powder, being converted into bicarbonate.

Purity Tests. —*Volatilises entirely when heated;*[1] *if diluted nitric acid be added to it in slight excess, and the solution be boiled, it will give no precipitate with chloride of barium,*[2] *or nitrate of silver.*[3] 59 *grains dissolved in one ounce of distilled water will be neutralised by* 1000 *grain measures of the volumetric solution of oxalic acid.* 20 *grains of carbonate of ammonia neutralise* 23½ *grains of citric acid,* 25½ *grains of tartaric acid.*

[1] Absence of fixed impurities. [2] Absence of sulphates and[3] chlorides.

SPIRITUS AMMONIÆ AROMATICUS—Aromatic Spirit of Ammonia—Spirit of Sal Volatile.—*Take of carbonate of ammonia,* 8 *ounces; strong solution of ammonia,* 4 *fluid ounces; volatile oil of nutmeg,* 4 *fluid drachms; oil of lemon,* 6 *fluid drachms; rectified spirit,* 6 *pints; water,* 3 *pints. Mix, and distil* 7 *pints.*

Test.—*Specific gravity,* 0·870.

Dose.—Of carbonate of ammonia, two to ten grains, in pill or solution; or, as an effervescing draught, twenty grains of the carbonate with the quantity of citric or tartaric acid necessary to neutralise it; or six drachms of lemon juice; of the aromatic spirit of ammonia, twenty minims to a drachm, sufficiently diluted. Twenty to thirty grains of carbonate of ammonia operate as an active and safe stimulating emetic.

Carbonate of ammonia acts as a stimulant, antacid, diaphoretic, expectorant, antispasmodic, &c.; in larger doses, as an emetic, and in over-doses as an irritant poison. Medicinally, the carbonate is employed in the same cases as were mentioned under liquor ammoniæ. It has been recommended in diabetes, scarlatina, rubeola, erysipelas; in lepra, psoriasis, and other skin diseases, &c. As an emetic it is sometimes used in narcotic poisoning, in chronic bronchitis, suffocative catarrh, and other cases in which there is great debility. Aromatic spirit of ammonia is used as an agreeable substitute for liquor ammoniæ, which it resembles, in proportion to its strength, in medicinal properties.

AMMONIÆ BICARBONAS ($NH_4O,2CO_2,HO$, or $(NH_4)\,HCO_3$)—Bicarbonate of Ammonia—Mild Carbonate of Ammonia—may be prepared by exposing the commercial sesquicarbonate of ammonia in powder to the air for twenty-four hours; one equivalent of carbonate of ammonia passes off, leaving bicarbonate. It crystallises in six-sided prisms, is permanent in air, and soluble in eight parts of water. It is more agreeable to the taste than the carbonate, the medicinal properties of which it possesses, but to a much less extent. It is antacid, stimulant, and diaphoretic. It may be given in doses of ten to thirty grains in solution: for effervescing draughts, twenty grains require eighteen grains of citric or nineteen of tartaric acid.

Ammonii Chloridum (NH_4Cl)—Chloride of Ammonium.—*Synonyms:* Ammoniæ Hydrochloras—Hydrochlorate of Ammonia—Ammoniæ

Murias—Muriate of Ammonia (NH_3,HCl, or NH_4Cl)—Sal Ammoniac—Hydrochlorate d'Ammoniaque—Salmiak.

May be formed by neutralising hydrochloric acid with ammonia, and evaporating to dryness. It is usually prepared by sublimation.

CHARACTERS.—*In colourless, inodorous, translucent fibrous masses, tough, and difficult to powder; soluble in water and in rectified spirit. Its aqueous solution when heated with caustic potash evolves ammonia,*[1] *and when treated with nitrate of silver forms a copious curdy precipitate.*[2]

PURITY TESTS.—*When heated it volatilises without decomposition, and leaves no residue.*[3]

[1] Forming chloride of potassium and ammonia, distinguishing it as an ammonia salt. [2] Characteristic of a chloride. [3] Absence of fixed impurities. The hydrochlorate is anhydrous, is nearly permanent in air, soluble in its own weight of boiling water, and in from three to four times that quantity of cold water, producing a low temperature. It has a disagreeable, pungent, acrid, saline taste.

Dose.—Five to twenty or more grains, in powder, pills, or solution. Externally, as a discutient lotion, two to four drachms in a pint of water or vinegar, with or without rectified spirit. As a refrigerant lotion, two ounces, with five ounces of nitre, dissolved in water.

Hydrochlorate of ammonia in over-doses acts as an irritant poison; in small medicinal doses it is stated to be alterative, sedative, diaphoretic, diuretic, emmenagogue, resolvent, liquefacient, discutient, refrigerant, &c., and in larger doses purgative. Formerly it was but little used internally in this country, though highly valued on the continent; but more recently it has met with greater acceptance. It has been recommended as a substitute for mercury and iodide of potassium for the removal of chronic indurations and enlargements, and in chronic inflammatory diseases; it has been given in neuralgic and rheumatic affections, in hemorrhages from the lungs, stomach, and uterus; in passive dropsies, especially of hepatic origin; in typhus, typhoid, and intermittent fevers; in chronic affections of the lungs, &c. In facial neuralgia originating in, or aggravated by, toothache, it frequently gives great relief. Externally, as a discutient lotion applied to glandular enlargements, incipient abscesses, ecchymoses, &c.; and as a refrigerant lotion in affections of the brain, sprains, &c.

AMMONIÆ ACETAS ($NH_4O,C_4H_3O_3$, or $NH_4C_2H_3O_2$)—Acetate of Ammonia—may be obtained in the crystalline form by the aid of the air-pump, but is so exceedingly deliquescent as to be practically useful only in the form of

Ammoniæ Acetatis Liquor. *Synonyms:* Solution of Acetate of Ammonia—Acetate of Ammonia ($NH_4O,C_4H_3O_3$, or $\mathbf{NH_4C_2H_3O_2}$) dis-

solved in water—Aqua Ammoniæ Acetatis—Spiritus Mindereri—Mindererus' Spirit—Ammonium Oxidatum Aceticum Liquidum.

Preparation.—*Take of acetic acid, 10 fluid ounces; carbonate of ammonia, $3\frac{1}{4}$ ounces, or a sufficiency; distilled water, $2\frac{1}{2}$ pints. Reduce the carbonate of ammonia to powder, and add it gradually to the acetic acid until a neutral solution is formed, then add the water.*

Though differing in its mode of preparation, this solution is about the same strength as the Liquor Ammoniæ Acetatis, London and Edinburgh, and about one-third stronger than the Dublin preparation. The great alteration in strength made in this well-known preparation in the first edition of the British Pharmacopœia gave rise to considerable dissatisfaction, and its reappearance in its old strength has been generally acceptable. The only objection to its use is that it is rather bulky.

Dose.—Two to six fluid drachms.

Solution of acetate of ammonia acts as a diaphoretic, diuretic, and refrigerant. Internally, it is administered at the outset of febrile and inflammatory cases, especially in the exanthemata; in influenza; in catarrh; in dysmenorrhœa; in inflammatory dropsy; in fits of drunkenness, &c. Externally, as a collyrium, with or without opiates; as a lotion, to bruises and inflamed surfaces and painful joints; in alopœcia, porrigo, &c.

Liquor Ammoniæ Citratis—Solution of the Citrate of Ammonia. Citrate of Ammonia ($3NH_4O,C_{12}H_5O_{11}$, or $\mathbf{(NH_4)_3C_6H_5O_7}$), dissolved in water.

Preparation.—*Take of citric acid, 3 ounces; strong solution of ammonia, $2\frac{3}{4}$ fluid ounces, or a sufficiency; distilled water, 1 pint. Dissolve the citric acid in the water, and add the solution of ammonia until the liquid is neutral to test-papers.*

Dose.—Two to six fluid drachms.

The solution of citrate of ammonia acts as a febrifuge, refrigerant, diaphoretic, and diuretic, and is employed in the same cases as solution of the acetate, than which it is considered to be more agreeable.

Ammoniæ Benzoas ($NH_4O,C_{14}H_5O_3$, or $NH_4C_7H_5O_2$)—Benzoate of Ammonia.

Preparation.—*Take of solution of ammonia, 3 fluid ounces, or a sufficiency; benzoic acid, 2 ounces; distilled water, 4 fluid ounces. Dissolve the benzoic acid in three fluid ounces of solution of ammonia previously mixed with the water; evaporate at a gentle heat, keeping ammonia in slight excess; and set aside, that crystals may form.*

Rationale.—There is a direct combination of the ammonia with the benzoic acid—$(NH_4)_2O + 2(HC_7H_5O_2) = 2(NH_4C_7H_5O_2) + H_2O$.

CHARACTERS.—*In colourless laminar crystals, soluble in water and alcohol. It gives a bulky yellowish precipitate with persalts of iron.*[1] *Its aqueous solution when heated with caustic potash evolves ammonia,*[2] *and if it be not too dilute, when acidulated with hydrochloric acid, it gives a deposit of benzoic acid.*[3]

PURITY TEST.—*When heated it sublimes without any residue.*[4]

[1] Benzoate of peroxide of iron. Proofs of its being a salt of ammonia,[2] and a benzoate.[3] [4] Absence of fixed impurity.

Dose.—Ten to thirty grains, in solution.

Benzoate of ammonia possesses medicinal properties similar to those of benzoic acid, than which it is more soluble, and therefore preferable. It renders the urine acid and irritating, its benzoic acid being converted into hippuric acid, in which state it is eliminated by the kidneys. It acts as a stimulating diuretic, and as a stimulant both to the urinary and pulmonary mucous membranes. It has been recommended in chronic inflammation with mucous discharge from the bladder, and in all cases in which there is a tendency to phosphatic deposits; in catarrhal affections of the pulmonary mucous membranes; in jaundice; and also in cases of uric acid deposits, and in gout, on the supposition that it possesses the property of converting uric acid into hippuric acid, but probably it has no such influence.

Ammoniæ Phosphas ($2NH_4O,HO,PO_5$, or $(NH_4)_2HPO_4$)—Phosphate of Ammonia.

PREPARATION.—*Take of diluted phosphoric acid, 20 fluid ounces; strong solution of ammonia, a sufficiency. Add the ammonia to the phosphoric acid until the solution is slightly alkaline; then evaporate the liquid, adding more ammonia from time to time, so as to keep it in slight excess, and when crystals are formed on the cooling of the solution, dry them quickly on filtering paper placed on a porous tile, and preserve them in a stoppered bottle.*

Rationale.—There is a direct union of two equivalents of the base with one equivalent of the tribasic acid—$(NH_4)_2O + H_3PO_4 = (NH_4)_2HPO_4 + H_2O$.

CHARACTERS.—*In transparent colourless prisms; soluble in water, insoluble in rectified spirit. When heated with caustic potash,*[1] *ammonia is evolved; the aqueous solution gives a yellow precipitate with nitrate of silver.*[2]

PURITY TESTS.—*If twenty grains of this salt be dissolved in water, and the solution of ammonio-sulphate of magnesia added, a crystalline precipitate falls,*[3] *which, when well washed upon a filter with solution of ammonia diluted with an equal volume of water, dried, and heated to redness, leaves* 16·8 *grains.*

Proofs of its being a salt of ammonia[1] and a phosphate,[2] forming the yellow phosphate of silver. [3] The precipitate is the ammonio-magnesian

phosphate (NH_4MgPO_4), which, when heated to redness, is converted into the bibasic pyrophosphate of magnesia ($Mg_2P_2O_7$), 16·8 grains of which correspond to the proper percentage of phosphoric acid in the phosphate of ammonia.

Dose.—Ten to forty grains, in solution.

Phosphate of ammonia has been chiefly recommended in the uric acid and gouty diatheses; it is supposed to dissolve the urate of soda by forming urate of ammonia and phosphate of soda, both of which are soluble. It has also been employed in rheumatism, and as a diaphoretic and discutient.

AMMONIÆ VALERIANAS ($NH_4O,C_{10}H_9O_3$, or $NH_4C_5H_9O_2$)—Valerianate of Ammonia—crystallises in pearly white quadrangular plates, which have a sharp, sweetish taste, and the odour of valerianic acid and ammonia. The salt is readily soluble in water and alcohol, and deliquesces in moist air. It may be prepared by neutralising valerianic acid in solution with gaseous ammonia or carbonate of ammonia. In doses of two to five grains, or more, in solution, it is employed as a diffusible stimulant and antispasmodic, in hysteria, neuralgia, chorea, epilepsy, &c.

AMMONIÆ HYDROSULPHURETUM—Hydrosulphuret of Ammonia—Hepatised Ammonia—mentioned amongst the test solutions, was formerly used in the treatment of diabetes, for the purpose of controlling the morbid appetite; it has also been recommended in heart disease, consumption, &c., but is scarcely ever used.

Group II. Metals of the Alkaline Earths—Barium, Calcium, Magnesium.

BARIUM (Ba = 68·5, or 137) is a greyish-white metal, having somewhat the appearance of silver; it melts below a red heat, burns with a red light, and, when exposed, soon oxidises. It is the metallic base of

BARYTA (BaO)—Barytes—Baryta—Oxide of Barium—takes its name from its great weight (βαρὺς, heavy). It has an alkaline taste and reaction, and is very poisonous.

BARII CHLORIDUM ($BaCl_2$)—Chloride of Barium—Terra Ponderosa Salita—Barytes Murias—is placed in the Appendix of the Pharmacopœia. It may be prepared by the action of hydrochloric acid upon carbonate of baryta ($BaCO_3 + 2HCl = BaCl_2 + H_2O + CO_2$), or by first heating sulphate of baryta with charcoal, whereby it is converted into sulphuret or sulphide of barium, and acting upon this with hydrochloric acid ($BaS + 2HCl = H_2S + BaCl_2$). It forms colourless, transparent, tabular, four-sided crystals, or rhombic plates, bevelled at the edges: these are permanent in air, or efflorescent, if the air be very dry; are inodorous, and have a disagreeable bitter acrid taste. With sulphuric acid and soluble sulphates, chloride of barium throws down a dense white

precipitate, insoluble in nitric acid. Medicinally, chloride of barium has been employed as an alterative, tonic, and deobstruent in scrofulous affections, &c.; but it is highly poisonous, and is rarely used. Dose, half a grain to a grain or two grains, only in solution. Antidote, a soluble sulphate (especially Epsom salts) to form the insoluble sulphate of Baryta.

Iodide of Barium (BaI_2), like the other barytic salts, is highly poisonous; it has been employed in scrofulous affections. Dose, a tenth of a grain to a grain, in solution. *Bromide of Barium* ($BaBr_2$) has been given for similar purposes.

CALCIUM (Ca = 20, or 40) is a yellowish malleable metal; sp. gr. 1·57. It is fusible at a red heat, and burns when heated in air. It slowly oxidises when exposed to the atmosphere, and is the metallic base of

Calx (CaO). *Synonyms:* Oxide of Calcium—Lime—Caustic Lime—Quicklime—Chaux—Kalk. An alkaline earth (CaO) with some impurities, obtained by calcining chalk or limestone, so as to expel carbonic acid.

CHARACTERS.—*In compact masses of a whitish colour, which readily absorb water, and which, when rather less than their weight of water is added, crack and fall into powder with the development of much heat.*[1] *The powder obtained by this process of slaking, when agitated with distilled water, gives, after filtration, a clear solution, which has an alkaline reaction, and yields a white precipitate with oxalate of ammonia.*[2]

PURITY TESTS.—*The powder obtained by slaking dissolves without much residue and without effervescence*[3] *in diluted hydrochloric acid; and if the solution thus formed be evaporated to dryness, and the residue redissolved in water, only a very scanty precipitate forms on the addition of saccharated solution of lime.*[4]

[1] Hydrate of lime (CaH_2O_2). [2] Oxalate of lime. [3] Absence of carbonates. [4] Mere traces of magnesia, alumina, or phosphate of lime.

CALCIS HYDRAS (CaO,HO, or CaH_2O_2).—HYDRATE OF LIME—SLAKED LIME.—*Take of lime, 2 pounds; distilled water, 1 pint. Place the lime in a metal pot, pour the water upon it, and when vapour ceases to be disengaged, cover the pot with its lid, and set it aside to cool. When the temperature has fallen to that of the atmosphere, put the slaked lime on an iron-wire sieve, and, by gentle agitation, cause the fine powder to pass through the sieve, rejecting what is left. Put the powder into a well-stoppered bottle, and keep it excluded as much as possible from the air. Slaked lime should be recently prepared.*

LIQUOR CALCIS—SOLUTION OF LIME—LIME WATER.—*Take of slaked lime, 2 ounces; distilled water, 1 gallon. Put the lime into a stoppered bottle containing the water, and shake well for two or three minutes. After twelve hours the excess of lime will have subsided, and the clear solution may be drawn off with a siphon as it is required for use, or transferred to a green glass bottle furnished with a well-ground stopper.*

TEST.—*Ten fluid ounces require for neutralisation at least* 200 *grain-*

measures of the volumetric solution of oxalic acid, which corresponds to 5·6 *grains of lime,* (CaO).

LIQUOR CALCIS SACCHARATUS—SACCHARATED SOLUTION OF LIME.—*Take of slaked lime,* 1 *ounce; refined sugar, in powder,* 2 *ounces; distilled water,* 1 *pint. Mix the lime and the sugar by trituration in a mortar. Transfer the mixture to a bottle containing the water, and having closed this with a cork, shake it occasionally for a few hours. Finally, separate the clear solution with a siphon, and keep it in a stoppered bottle.*

TEST.—*Specific gravity,* 1·052·460·2 *grains by weight* (1 *fluid ounce*) *require for neutralisation* 254 *grain-measures of the volumetric solution of oxalic acid, which corresponds to* 7·11 *grains of lime in* 1 *fluid ounce.*

Solution of lime is a limpid, colourless, inodorous liquid, having a disagreeable, nauseous, caustic taste, and an alkaline reaction. When exposed to the air, it absorbs carbonic acid, which at first forms a pellicle of carbonate of lime upon the surface, and if farther exposed, the whole of the lime is ultimately precipitated; hence it is necessary to keep it in constantly full and well-stoppered bottles, which are directed to be of green glass, because the lime slowly acts upon the oxide of lead of white bottles. Cold water dissolves more lime than that of a higher temperature. 656 parts of water at 32°, 750 parts at 60°, and 1280 parts at 212°, equally dissolve one part of lime. The addition of sugar increases the solubility of lime, so that the saccharated is much stronger than the simple solution, the latter containing only 0·56 of a grain, whilst the former contains 7·11 grains, in each ounce. The saccharated solution, being much stronger, has a more caustic and disagreeable taste than the simple solution; it also is readily converted into carbonate of lime by exposure to the atmosphere, and when two-thirds of the lime is thus changed, the solution becomes glutinous.

Dose.—Of the simple solution, half-an-ounce to two or three ounces, in milk, or alone; of the saccharated solution, half-a-drachm to two or three drachms, well diluted; for children, fifteen to thirty minims, well diluted; it may be given in milk.

Lime water acts as an antacid and astringent, and also as a resolvent, lithontriptic, &c. It tends to turn the urine alkaline, and when long continued, it interferes with the functions of digestion and secretion, and therefore should be discontinued from time to time. It has been employed as an antacid in dyspepsia with vomiting, acidity of the stomach, and cardialgia; also in gastrodynia and ulcer of the stomach; in diarrhœa, especially of children; in dysentery; as a solvent of urates it has been given in urinary deposits, and in the dyspepsia of gouty and rheumatic subjects; as a palliative in cancer of the stomach; in the vomiting of pregnancy; in diabetes, scrofula, phthisis, &c. As an antidote to poisoning by the mineral acids and oxalic acid. As a lotion, it has been recommended in scabies, in tinea, and other skin diseases. As an injection, in leucorrhœa, in excoriations of the vaginal mucous membrane,

in pruritus, in cancer of the uterus, and in gleet. As an enema for the expulsion of ascarides, &c. In cases of chronic vomiting, the vomiting of pregnancy, and in the chronic diarrhœa of children, the saccharated solution, well diluted, is largely used.

LINIMENTUM CALCIS—LINIMENT OF LIME—CARRON OIL.—*Take of solution of lime and olive oil, of each* 2 *fluid ounces. Mix together with agitation.*

This liniment was first used at the Carron Iron Works, and hence derived its popular name; it is applied to burns and scalds, and as an antidote in poisoning by the mineral acids, oxalic acid, arsenic, &c.

Cræta Preparata—Prepared Chalk freed from most of its impurities by elutriation, and afterwards dried in small masses which are usually of a conical form. It is carbonate of lime, $CaCO_3$, nearly pure.

CHARACTERS.—*A white amorphous powder, effervescing with acids, and dissolving with only a slight residue in diluted hydrochloric acid.*[1] *This solution, when supersaturated with solution of ammonia, gives upon the addition of oxalate of ammonia, a copious white precipitate.*[2]

PURITY TEST.—*The salt formed by dissolving prepared chalk in hydrochloric acid, if rendered neutral by evaporation to dryness and redissolved in water, gives only a very scanty precipitate on the addition of saccharated solution of lime.*[3]

[1] A trace of silica. [2] Oxalate of lime, which would be soluble in the acid solution, hence the excess of ammonia. [3] Absence, or nearly so, of magnesia and alumina, and the other alkaline earths. Prepared chalk is insoluble in water, but forms a cream when suspended in it; it is permanent in air, inodorous and tasteless.

MISTURA CRETÆ—CHALK MIXTURE.—*Take of prepared chalk,* $\frac{1}{4}$ *ounce; gum acacia, in powder,* $\frac{1}{4}$ *ounce; syrup,* $\frac{1}{2}$ *fluid ounce; cinnamon water,* $7\frac{1}{2}$ *fluid ounces. Triturate the chalk and gum acacia with the cinnamon water, then add the syrup, and mix.*

PULVIS CRETÆ AROMATICUS—AROMATIC POWDER OF CHALK. Synonyms: *Confectio Aromatica*, Lond.—*Pulvis Cretæ Compositus*, Dub. *Take of cinnamon bark, in powder,* 4 *ounces; nutmeg, in powder, saffron, in powder, of each* 3 *ounces; cloves, in powder,* $1\frac{1}{2}$ *ounce; cardamom seeds, in powder,* 1 *ounce; refined sugar, in powder,* 25 *ounces; prepared chalk,* 11 *ounces. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.*

Calcis Carbonas Præcipitata (CaO,CO_2 or $CaCO_3$)—Precipitated Carbonate of Lime.

PREPARATION.—*Take of chloride of calcium,* 5 *ounces; carbonate of soda,* 13 *ounces; boiling distilled water, a sufficiency. Dissolve the chloride of calcium and carbonate of soda each in two pints of the water; mix the two solutions; and allow the precipitate to subside. Collect this on a calico filter, wash it with boiling distilled water, until the washings cease*

to give a precipitate with nitrate of silver, and dry the product at the temperature of 212°.

Rationale.—The chloride of calcium and carbonate of soda interchange with one another, forming chloride of sodium and carbonate of lime; the carbonate subsides, leaving the chloride of sodium in solution, and any of the latter that may be adherent to the carbonate is entirely removed by the washings, otherwise the silver would be precipitated as a chloride.

CHARACTERS.—*A white crystalline powder, insoluble in water, dissolving in hydrochloric acid with effervescence. The solution, when neutralised by ammonia, lets fall a copious white precipitate on the addition of oxalate of ammonia.*

TESTS.—*With diluted nitric acid it gives a clear solution, which, if perfectly neutral, and deprived of carbonic acid by boiling, is not precipitated by saccharated solution of lime added in excess, or by the solution of nitrate of silver.*

The nitrate of silver would detect any chloride. Precipitated carbonate of lime is purer, finer, and whiter than the creta præparata, but the latter is more commonly used. The doses and medicinal properties of both are alike. The precipitated carbonate enters into the *Trochiscus Bismuthi.*

Doses.—Of creta præparata, or calcis carbonas præcipitata, ten grains and upwards, in powder or mixture, or in the form of *Carrara Water* (liquor calcis bicarbonatis), in which the carbonate is dissolved by an excess of carbonic acid. Of mistura cretæ, one or two ounces simply, or as a vehicle for other remedies. Of pulvis cretæ aromaticus, ten grains and upwards.

Prepared (or precipitated) chalk acts as antacid, astringent, absorbent, desiccant, antidote, &c. It is given as an antacid in dyspepsia with acidity, especially when complicated with diarrhœa, and in the diarrhœa of children. Externally, it is used as a desiccant, dusted over ulcers, burns, excoriations, &c., to absorb their irritating discharges and to exclude the air. It is used as an antidote in poisoning by the mineral acids, oxalic acid, and chloride of zinc. Chalk is apt to form intestinal concretions when it is long continued; to guard against this, an occasional laxative is necessary. Mistura cretæ and pulvis cretæ aromaticus are used to check diarrhœa.

Calcii Chloridum ($CaCl$, or $CaCl_2$). *Synonyms:* Chloride of Calcium—Muriate of Lime—Hydrochlorate of Lime—Hydrochlorate de Chaux—Chlorure de Calcium—Salzsaurer Kalk.

PREPARATION.—*It may be formed by neutralising hydrochloric acid with carbonate of lime, adding a little solution of chlorinated lime and slaked lime to the solution, filtering, evaporating until it becomes solid, and finally drying the salt at about* 400°.

Rationale.—On mixing the hydrochloric acid and the carbonate of lime, chloride of lime is formed, and carbonic acid is evolved. Thus

$CaCO_3 + 2HCl = CaCl_2 + H_2O + CO_2$. But carbonate of lime is apt to contain carbonate of magnesia and protocarbonate of iron as impurities. These are converted by the hydrochloric acid into their respective chlorides. The slaked lime at once precipitates the magnesia. The chlorinated lime and slaked lime also react upon the protochloride of iron, converting it into the insoluble peroxide of iron and chloride of calcium, the former being removed by filtration. Thus $4FeCl_2 + CaCl_2O_2 + 4CaH_2O_2 + 2H_2O = 2(Fe_2O_3 6H_2O) + 5CaCl_2$.

CHARACTERS.—*In white agglutinated masses, dry, but very deliquescent; evolves no chlorine or hypochlorous acid on the addition of hydrochloric acid; and is entirely soluble in twice its weight of water, also in alcohol.*

TEST.—*The aqueous solution is not precipitated by the addition of lime water.*

[1] Absence of chloride of lime. [2] Contains no carbonic acid.

Besides the above anhydrous form, chloride of calcium occurs in striated six-sided prismatic crystals, with six equivalents of water.

It is used as a test, and also, in consequence of its avidity for water, to dry gases and to remove water from solids and liquids.

Medicinally, chloride of calcium has been used in the treatment of scrofula, for the removal of glandular and other tumours, in certain chronic skin diseases, as lupus, in ovarian disease, &c. It is said to act as a stimulant of the lymphatic glandular system, and to be tonic and deobstruent. In large doses it is an irritant poison. It is given only in solution, beginning with small doses (gr. v, thrice a-day, gradually increased to gr. xv), whilst at the same time solutions of different strength may be applied locally. Of the following solutions, which are placed in the Appendix of the Pharmacopœia as tests merely, the weaker may be given internally.

LIQUOR CALCII CHLORIDI—SOLUTION OF CHLORIDE OF CALCIUM.—*Take of chloride of calcium,* 1 *ounce; distilled water,* 10 *fluid ounces; dissolve and filter.* Of this solution twenty drops, gradually increased to a drachm, may be given in milk.

SOLUTION (SATURATED) OF CHLORIDE OF CALCIUM.—*Take of chloride of calcium,* 4 *ounces; distilled water,* 5 *fluid ounces. Dissolve and filter.* This is used only as a test.

OS USTUM—BONE ASH.—*The residue of bones which have been burned to a white ash in contact with air. Consists principally of phosphate of lime mixed with about* 10 *per cent. of carbonate of lime, and a little fluoride of calcium and phosphate of magnesia.* It is used to prepare the phosphate of lime and the phosphate of soda.

Calcis Phosphas ($3CaO,PO_5$, or $Ca_3P_2O_8$). *Synonyms:* Precipitated Phosphate of Lime—Bone Phosphate of Lime—Triphosphate of Lime.

PREPARATION.—*Take of bone ash,* 4 *ounces; hydrochloric acid,* 6 *fluid ounces; water,* 2 *pints; solution of ammonia,* 12 *fluid ounces, or a sufficiency; distilled water, a sufficiency. Digest the bone ash in the hydrochloric acid, diluted with a pint of water, until it is dissolved. Filter the solution, if necessary; add the remainder of the water, and afterwards the*

solution of ammonia, until the mixture acquires an alkaline reaction; and, having collected the precipitate on a calico filter, wash it with boiling distilled water as long as the liquid which passes through occasions a precipitate when dropped into solution of nitrate of silver acidulated with nitric acid. Dry the washed product at a temperature not exceeding 212°.

Rationale.—First, the hydrochloric acid decomposes the carbonate of lime, dispelling its carbonic acid and forming chloride of calcium and water ($CaCO_3 + 2HCl = CaCl_2 + H_2O + CO_2$) : at the same time it converts the insoluble phosphate into the soluble superphosphate of lime, again forming chloride of calcium ($Ca_3P_2O_8 + 4HCl = CaH_4P_2O_8 + 2CaCl_2$). *Second,* by the addition of two equivalents of ammonia hydrate, the four equivalents of chlorine are abstracted from the chloride of calcium to form chloride of ammonium, whilst the two atoms of lime (formed by the two equivalents of calcium with the two of oxygen from the ammonia), returning to the soluble superphosphate, reconvert it into water and the insoluble phosphate, which latter is precipitated $2(NH_4)_2O + 2CaCl_2 + CaH_4P_2O_8 = 4NH_4Cl + Ca_3P_2O_8 + 2H_2O$). When the liquid no longer gives a precipitate with the acidulated solution of nitrate of silver, all the chloride of ammonium has been washed out.

CHARACTERS.—*A light white amorphous powder, insoluble in water, but soluble without effervescence in diluted nitric acid. The solution continues clear when an excess of acetate of soda is added to it, but lets fall a white precipitate on the subsequent addition either of a little oxalate of ammonia*[1] *or of perchloride of iron*[2].

PURITY TESTS.—*Ten grains dissolve perfectly and without effervescence in diluted hydrochloric acid;*[3] *and the solution yields with ammonia a white precipitate, insoluble in boiling solution of potash, and weighing ten grains when washed and dried.*[4]

Characteristic of a salt of lime,[1] and a phosphate.[2] [3] Absence of insoluble impurities and carbonates. [4] This is simply a repetition of the preparation process, and as nothing is removed by the potash, the ten grains of pure phosphate are restored.

Dose.—Ten to twenty or thirty grains. Phosphate of lime may be elegantly prepared for medicinal use by dissolving it in dilute phosphoric acid, and forming it into a syrup. There are several such syrups, in which it is usually combined with phosphate of iron and other phosphates, and they are made so as to be given in tea-spoonful doses.

Phosphate of lime has been used in the treatment of rickets, mollities ossium, tabes mesenterica, scrofula, chronic syphilitic ulcers, in intermittent fever, &c. It has been recommended with the view of supplying a deficiency of phosphate of lime to the system, but practically it has not succeeded. It enters into *Pulvis antimonialis.*

CALCII SULPHURETUM—Sulphuret of Calcium—Sulphide of Calcium—Hepar Calcis—Liver of Lime—is composed of pentasulphide of calcium and hyposulphite of lime ($2CaS_5 + CaH_2S_2O_4$.) It may

be prepared by diffusing lime through water and passing into it a current of sulphuretted hydrogen; by evaporation, a soft mass, having a characteristic sulphurous odour, is obtained. A solution may also be prepared by boiling an ounce and a-half of sulphur with half-an-ounce of quicklime in a pint of water for ten minutes, with constant stirring. The solution is to be cleared by straining. Sulphuret of calcium is used only externally in lotions, baths, and ointments, for the cure of scabies and other skin diseases, and as a depilatory. For scabies, a lotion may be made containing from six drachms to an ounce dissolved in a pint of distilled water. It is at once a cleanly, certain, and rapid cure for that disease.

MAGNESIUM ($Mg=12$) is a greyish-white or silvery metal, which is ductile and malleable, is fusible at a red heat, burns with an intensely brilliant, white light, and is permanent in dry, but slowly oxidises in damp air.

Magnesia (MgO). *Synonyms:* Magnesia—Pure Oxide of Magnesium—Calcined Magnesia—Magnesia Usta—Talc Earth—Talkerde—Bittererde—Magnésie. *Varieties:* 1. Magnesia—Magnesia Ponderosa—Heavy Magnesia. 2. Magnesia Levis—Light Magnesia—Light Calcined Magnesia.

PREPARATION.—1. *Of Magnesia; Take of carbonate of magnesia,* 4 *ounces. Put it into a Cornish or Hessian crucible closed loosely by a lid, and expose it to a low red heat, until a small quantity taken from the centre of the crucible, when it has cooled, and dropped into diluted sulphuric acid, causes no effervescence.*

2. *Of Magnesia Levis: Take of light carbonate of magnesia,* 4 *ounces. Put it into a Cornish or Hessian crucible closed loosely by a lid, and expose it to a red low heat, until a small quantity taken from the centre of the crucible, when it has been cooled, and dropped into diluted sulphuric acid, causes no effervescence.*

Rationale.—The process is the same in both cases. Officinal carbonate of magnesia consists of three equivalents of carbonate of magnesia, one equivalent of magnesia, and five equivalents of water, thus $\{(MgCO_3)_3MgO)5H_2O\}$: by heat, the carbonic acid and water of this compound are driven off, leaving $4MgO$. Effervescence with sulphuric acid would indicate the presence of carbonate. The product is to be preserved from the air, otherwise it would absorb carbonic acid and water, and be reconverted into the hydrated carbonate.

CHARACTERS.—1. *Of Magnesia: A white powder, insoluble in water, but readily dissolved by acids without effervescence.*[1] *Its solution in hydrochloric acid, when neutralised by a mixed solution of ammonia and chloride of ammonium, gives a copious crystalline precipitate when phosphate of soda is added to it.*[2]

2. *Of Magnesia Levis: A bulky white powder, differing from the preceding preparation only in its greater levity, the volumes corresponding to the same weight, being to each other in the ratio of three and a-half to one.*

[1] Distinguishing magnesia from its carbonate. [2] Chloride of ammonium prevents the partial precipitation of magnesia which would take

place if ammonia only were added : on the addition of phosphate of soda there is a copious precipitate of the ammonio-phosphate of magnesia ($MgNH_4PO_4$). Magnesia is infusible, inodorous, and tasteless or insipid, and should be impalpable, but it is sometimes slightly gritty. It is almost insoluble in water, but slightly soluble in alcohol, and when moistened with water, reacts as an alkali with vegetable tests. It is more soluble in cold than in hot water, hence the solution when heated becomes turbid, but resumes its clearness on cooling. It is the only oxide of magnesium, is insoluble in solutions of potash and soda, but readily combines with acids. Sp. gr. 2·3. Magnesia is readily distinguishable from the other alkaline earths by forming a soluble and bitter sulphate.

PURITY TESTS (*for both varieties*).—*Dissolved in nitric acid, and neutralised with a mixture of ammonia and chloride of ammonium, it does not give any precipitate with oxalate of ammonia,*[1] *or chloride of barium.*[2]

Absence of lime[1] and sulphates.[2] It may contain silica, alumina, iron, &c., derived from the carbonate, but it is usually pure.

Dose.—Of either kind, ten to twenty grains, as an antacid; twenty to sixty grains and upwards, as a cathartic. For infants, two to ten grains. It may be given suspended in milk or water.

Magnesia, in both of these forms, acts as an antacid in small doses, and as a laxative in larger doses. It combines with the acids met with in the *primæ viæ* to form purgative salts. It tends to render the urine alkaline, and to diminish the quantity of uric acid and urates. It is employed as an antacid in acidity of the *primæ viæ*, with cardialgia and gastralgia, and especially in the acidity with diarrhœa of infants. It is said also to act as a sedative in the stomach and bowels, thereby, as well as by its antacid properties, diminishing gastro-intestinal irritation. It is given to arrest the vomiting produced by irritability of the stomach, and to relieve the vomiting and cardialgia incident to pregnancy. It is given in the gouty, rheumatic, and lithic acid diatheses. As a purgative it is not much used, except in the double capacity of antacid and laxative. When given in large quantities, or long continued, it is apt to accumulate and form concretions of considerable size in the bowels, a result which should be obviated by the occasional use of a brisk cathartic. Externally, it has been recommended, in the form of ointment, as an application to eczema. In the absence of other remedies, it may be used as an antidote in cases of poisoning by the mineral acids, but the great heat generated by its use renders it objectionable. It is also used as an antidote in poisoning by oxalic acid, arsenic, &c.

Magnesiæ Carbonas $\{(MgO,CO_2)_3 + MgO + 5HO)$, or $(MgCO_3)_3 MgO5H_2O\}$. *Synonyms:* Carbonate of Magnesia—Carbonate of Magnesium—Magnesiæ Subcarbonas—Magnesia Alba—Magnesia Aerata—Carbonate de Magnésie—Kohlensaure Bittererde—Kohlensaure Talkerde.

Varieties: 1. Magnesiæ Carbonas—Carbonate of Magnesia (*Synonym:* Magnesiæ Carbonas Ponderosum, *Dublin*). 2. Magnesiæ Carbonas Levis —Light Carbonate of Magnesia.

Preparation.—1. *Of Carbonate of Magnesia: Take of sulphate of magnesia,* 10 *ounces; carbonate of soda,* 12 *ounces; boiling distilled water, a sufficiency. Dissolve the sulphate of magnesia and the carbonate of soda each in a pint of the water, mix the two solutions, and evaporate the whole to perfect dryness by means of a sand bath. Digest the residue for half-an-hour with two pints of the water, and having collected the insoluble matter on a calico filter, wash it repeatedly with distilled water, until the washings cease to give a precipitate with chloride of barium. Finally, dry the product at a temperature not exceeding* 212°.

2. *Of Light Carbonate of Magnesia: Take of sulphate of magnesia,* 10 *ounces; carbonate of soda,* 12 *ounces; distilled water, a sufficiency. Dissolve the sulphate of magnesia and the carbonate of soda each in half-a-gallon of the water, mix the two solutions cold, and boil the mixture in a porcelain dish for fifteen minutes. Transfer the precipitate to a calico filter, and pour upon it repeatedly boiling distilled water, until the washings cease to give a precipitate with chloride of barium. Lastly, dry by a heat not exceeding* 212°.

Rationale.—The constitution of the salt obtained is the same in both cases, and it is not a simple carbonate, but a combination of three equivalents of the carbonate with one equivalent of magnesia, and five equivalents of water $\{(MgCO_3)_3MgO5H_2O\}$. Its formation may be thus explained: $4(MgSO_47H_2O) + 4Na_2CO_310H_2O = (MgCO_3)_3MgO5H_2O + 4Na_2SO_410H_2O + 23H_2O + CO_2$. The complexity of this decomposition is due to the formation, by a part of the ingredients, of an atom of bicarbonate of magnesia, two atoms of carbonic acid uniting with one equivalent of magnesia, and thereby leaving one equivalent of magnesia untransformed into carbonate. The bicarbonate of magnesia thus formed is held in solution until one atom of its carbonic acid is expelled by boiling, when the carbonate is precipitated. The presence of carbonate or sulphate of soda would be detected by the washings giving a precipitate with chloride of barium. A higher temperature than 212° might expel the carbonic acid, leaving magnesia. The heavy carbonate is produced by using concentrated solutions at a high temperature, the light carbonate by using diluted solutions and a low temperature.

Characters.—1. *Of Carbonate: A white granular powder, which dissolves with effervescence in the diluted mineral acids, yielding solutions which, when first treated with chloride of ammonium, are not disturbed by the addition of an excess of solution of ammonia, but yield a copious crystalline precipitate upon the addition of phosphate of soda.*[1]

2. *Of Light Carbonate: A very light powder, which, when examined under the microscope, is found to be partly amorphous, with numerous slender prisms intermixed. The other characters and tests are the same as those of carbonate of magnesia.*

[1] Ammonio-phosphate of magnesia. Carbonate of magnesia is met with as a white, inodorous, tasteless or insipid powder; or in white cubical masses, into which it is compressed whilst moist. Like magnesia, it is nearly insoluble in water, but more soluble in cold than in boiling water. It is soluble in water aërated with carbonic acid, when, in fact,

it becomes bicarbonate. It is permanent in air, and when moistened has a slightly alkaline reaction. The crystalline form of the light carbonate is due to the slowness of its precipitation. The light carbonate occupies about three times the space of the heavy carbonate. Carbonate of magnesia enters into the constitution of *Trochisci Bismuthi* and of Liquor Magnesiæ Carbonatis.

PURITY TESTS (for both varieties.)—*With excess of hydrochloric acid it forms a clear solution, in which chloride of barium causes no precipitate.*[1] *Another portion of the solution supersaturated with ammonia gives no precipitate with oxalic acid,*[2] *or sulphuretted hydrogen.*[3] *Fifty grains calcined at a red heat are reduced to twenty-two.*[4]

[1] Absence of sulphate. [2] Contains no lime. [3] Absence of alumina, iron, &c. [4] This consists of anhydrous magnesia, MgO.

Dose (of either kind).—As an antacid, ten to twenty grains; as a laxative, twenty to sixty grains, or more. It may be given suspended in milk or water, or in the form of an effervescing draught, in the proportion of fourteen grains to twenty grains of citric acid.

Carbonate of magnesia, in both of these forms, acts as an antacid, absorbent, and laxative. It resembles calcined magnesia in its medicinal properties, except that in its union with acids in the *primæ viæ* it disengages carbonic acid gas, giving rise to unpleasant eructations. It is employed as an antidote in poisoning by oxalic acid.

LIQUOR MAGNESIÆ CARBONATIS, Solution of Carbonate of Magnesia. *Synonym:* Fluid Magnesia—Aqua Magnesiæ Bicarbonatis.

PREPARATION.—*Take of sulphate of magnesia,* 2 *ounces; carbonate of soda,* $2\frac{1}{2}$ *ounces; distilled water, a sufficiency. Dissolve the two salts separately, each in half-a-pint of water. Heat the solution of sulphate of magnesia to the boiling point, then add to it the solution of carbonate of soda, and boil them together until carbonic acid ceases to be evolved. Collect the precipitated carbonate of magnesia on a calico filter, and wash it with distilled water until what passes ceases to give a precipitate with chloride of barium. Mix the washed precipitate with a pint of distilled water, and, putting them into a suitable apparatus, pass into it pure washed carbonic acid gas, obtained by the action of sulphuric acid on chalk. Let the mixture remain in contact with excess of carbonic acid, retained there under pressure for about twenty-four hours, then filter the liquid to remove any undissolved carbonate of magnesia, and again pass carbonic acid gas into the filtered solution. Finally, keep the solution in a bottle securely closed to prevent the escape of carbonic acid. This solution contains about* 13 *grains of carbonate of magnesia in a fluid ounce.*

Rationale.—On mixing the sulphate of magnesia and carbonate of soda, sulphate of soda is retained in solution, and carbonate of magnesia is precipitated. Thus $MgSO_4 + Na_2CO_3 = MgCO_3 + Na_2SO_4$. The carbonate of magnesia is thoroughly freed from any sulphate when the washings cease to give a precipitate with chloride of barium. The car-

bonate is dissolved by excess of carbonic acid, but is apt to be precipitated on escape of the acid, hence the necessity of keeping the solution in a closed vessel.

CHARACTERS AND TESTS.—*Effervesces slightly, or not at all, when the containing vessel is first opened. The liquid is clear and free from any bitter taste.*[1] *A fluid ounce of it, evaporated to dryness, yields a white solid residue, which, after being calcined, weighs not less than five grains.*[2] *This residue is insoluble in water, and answers to the tests for magnesia.*

[1] Does not contain any of the sulphate. [2] Proportion of oxide in thirteen grains of the carbonate.

Dose.—One to two fluid ounces.

The magnesia is here kept in solution by the excess of carbonic acid. It is, properly speaking, a solution of the bicarbonate (MgH_22CO_3). This salt cannot be obtained in the solid form; but in solution forms a useful medicine, known by the names given in the Pharmacopœia as its synonyms, as well as some others, such as aërated magnesia water, &c., or distinguished by the names of the manufacturers, as Murray's, Dinneford's, Husband's fluid magnesia. It is an exceedingly agreeable form in which to prescribe magnesia, and now that it is included in the officinal list, a uniform strength is secured. On the escape of the carbonic acid, hydrated carbonate of magnesia is deposited; the solution should therefore be kept in well-stoppered bottles. Solution of bicarbonate of magnesia is used as an antacid, either alone or as an effervescing draught with citric acid or lemon juice.

Magnesiæ Sulphas ($MgO,SO_3 + 7HO$, or $MgSO_47H_2O$). *Synonyms:* Sulphate of Magnesia—Magnesium Oxidatum Sulphuricum Depuratum—Sal Amarus—Bitter Purging Salt—Epsom Salts—Sulfate de Magnésie—Schwefelsaure Bittererde.

Sulphate of magnesia may be obtained either from *bittern* or from *dolomite.* Bittern is the liquid which remains after most of the chloride of sodium has been removed from *sea-water* by evaporation; the bittern consists chiefly of sulphate of magnesia and chloride of magnesium in solution, and by boiling this down with the addition of sulphuric acid, the chloride is converted into sulphate, which is thus obtained. When dolomite or magnesian limestone (carbonate of lime and magnesia) is used, it is first calcined, powdered, and diffused through water; sulphuric acid is then added to form the sulphates of lime and magnesia, from which the latter, from its ready solubility, is easily separated. From either of these sources the sulphate is subject to impurity: if from bittern, it may contain chlorides, and consequently be deliquescent; if from dolomite, it may contain iron, alumina, &c. Or it may be obtained from the native carbonate of magnesia (magnesite), by saturating it with sulphuric acid.

CHARACTERS.—*In minute colourless and transparent rhombic prisms, possessing a bitter taste. It readily dissolves in water, and the solution gives copious white precipitates with chloride of barium,*[1] *and with a mixed solution of ammonia, chloride of ammonium, and phosphate of soda.*[2]

[1] Characteristic of a sulphate. [2] Characteristic of magnesia.

It commonly occurs in acicular crystals. The rhombic prisms, sometimes of large size, are obtained by slow crystallisation. The crystals

are inodorous, permanent in air, unless dry, when they are slightly efflorescent; when contaminated with chlorides they deliquesce. The sulphate is soluble in its own weight of cold, and in still less of boiling water, but is insoluble in alcohol. Heat drives off its water of crystallisation, but does not decompose the salt.

PURITY TESTS.—*Its aqueous solution at ordinary temperature is not precipitated by oxalate of ammonia,*[1] *nor should it give a brown precipitate with chlorinated lime or soda.*[2] *The precipitate given by carbonate of soda, when obtained from a boiling solution of one hundred grains of the salt, should, when well washed, dried, and heated to redness, weigh* 16·26 *grains.*[3]

[1] Absence of lime. [2] Absence of iron. If iron were present it would be thrown down as the brown hydrated oxide. [3] Of anhydrous magnesia, which leaves no room for impurities. It is seldom adulterated; the chief impurities are chloride of magnesium and sulphate of soda.

ENEMA MAGNESIÆ SULPHATIS—ENEMA OF SULPHATE OF MAGNESIA. Synonym: *Enema catharticum*, Ed. Dub. *Take of sulphate of magnesia,* 1 *ounce; olive oil,* 1 *fluid ounce; mucilage of starch,* 15 *fluid ounces. Dissolve the sulphate of magnesia in the mucilage of starch, add the oil, and mix.*

Dose.—Sixty grains to half-an-ounce, or more, largely diluted in water, with or without the addition of a little sulphuric acid, which renders it somewhat more palatable. It acts more effectively in proportion to its dilution. It may be given with infusion of senna or acid infusion of roses. The officinal enema may be used in the quantity prescribed.

Sulphate of magnesia acts as a refrigerant and somewhat depressing saline cathartic, increasing the peristaltic action of the bowels, and producing watery evacuations. In small doses it is diuretic. It is a suitable purgative in the febrile and inflammatory affections of robust subjects; and in the constipation with congestion of the portal system in persons of plethoric habit. It is used as an antidote in cases of poisoning by the salts of lead and baryta, their sulphates being insoluble. It enters into the constitution of sea-water and of many mineral waters.

MAGNESIÆ CITRAS—Citrate of Magnesia—differs in its properties according to the method of its preparation; the intention is to produce $Mg_32C_6H_5O_7$, but it is difficult to prepare. When precipitated from a solution it is insoluble, but is more soluble if the ingredients (carbonate of magnesia and citric acid) are mixed in the dry state, or with the aid of a very small proportion of water and at a low temperature. *Granular effervescing Citrate of Magnesia* is made with sulphate of magnesia, citric acid, tartaric acid, and bicarbonate of soda (*vide* p. 68). It is given in doses of a teaspoonful, or more, as a mild purgative.

Group III. Metals of the Earths Proper—Aluminium and Cerium.

ALUMINIUM ($Al=13{\cdot}75$, or $27{\cdot}5$) is a brilliant white silver-like metal, malleable and ductile; it may be obtained from its chloride by heating with sodium, or from *cryolite,* which is a double fluoride of aluminium and sodium, by the same process. Aluminium remains unchanged in dry air and in water, but moist air tarnishes it. Specific gravity 2·6. It is the metallic base of alumina.

Alumina (Al_2O_3) is the only recognised oxide of aluminium. It may be obtained from alum, by adding to it an excess of ammonia, hydrate of alumina being precipitated; or by decomposing a solution of alum by an excess of carbonate of potash, washing it repeatedly, redissolving it in hydrochloric acid, and ultimately precipitating it by ammonia. The hydrate of alumina thus obtained may be rendered anhydrous by heating it to redness. Alumina is colourless, tasteless, inodorous, and insoluble in water, though it has a strong affinity for it. When mixed with water it forms a plastic mass. Alumina is readily dissolved by potash and soda, and when moist it is also readily soluble in the concentrated acids, and sparingly in caustic ammonia. The salts of alumina are but feebly basic, and have all more or less an acid reaction.

Alumen ($NH_4O,SO_3,Al_2O_3,3SO_3+24HO$, or $NH_4Al(SO_4)_2 12H_2O$). A sulphate of ammonia and alumina crystallised from solution in water. *Synonyms:* Alum—Ammonia Alum.

Alum is obtained from an argillaceous slaty rock, known as aluminous shale, slate, or rock, which consists of alumina in combination with a sulphide of iron. By exposure to the air, or by calcination, the iron and sulphur are oxidised, the former into oxide of iron, the latter into sulphuric acid, sulphates of alumina and iron being formed. From this compound the sulphate of iron is separated by solution and crystallisation, and a salt of ammonia is added to the solution of sulphate of alumina, whereby the double sulphate of alumina and ammonia is obtained, which is purified by repeated solution and crystallisation. The Hurlet Alum Works, near Paisley, and Sandsend Alum Works, near Whitby, are the chief manufactories in Great Britain.

Characters.—*In colourless transparent crystalline masses, exhibiting the faces of the regular octahedron, and having an acid sweetish astringent taste. Its aqueous solution gives with caustic potash or soda a white precipitate, soluble in an excess of the reagent,*[1] *and the mixture evolves ammonia, especially when heated. The aqueous solution gives an immediate precipitate with chloride of barium.*[2]

[1] Characteristic of alumina salts, the precipitate is reproduced by the addition of hydrochlorate of ammonia. [2] Characteristic of a sulphate. Alum is permanent in air, or slightly efflorescent if the air be dry; it is soluble in about sixteen parts of cold water, and in less than its own weight of boiling water. A moderate heat causes it to melt in its water of crystallisation; and when by continued heat this is driven off, burnt alum is left as a spongy powder.

Purity Tests.—*It does not acquire a blue colour from the addition of yellow or red prussiate of potash.*[1]

[1] It contains iron neither as a persalt nor protosalt. The iron is derivable from the alum shale.

ALUMEN EXSICCATUM—Dried Alum—Alumen Ustum.—*Take of alum,* 4 *ounces. Heat the alum in a porcelain dish or other suitable vessel till it liquefies, then raise and continue the heat, not allowing it to exceed* 400°, *till aqueous vapour ceases to be disengaged, and the salt has lost* 47 *per cent. of its weight. Reduce the residue to powder, and preserve it in a well-stoppered bottle.*

Dose.—Ten to thirty grains in solution, in pills, or as an electuary; as a gargle, sixty grains or more to eight ounces of liquid; as a lotion, sixty grains to half-an-ounce to a pint of liquid, or in the form of alum whey. Dried alum is used only externally.

Alum acts as an astringent and styptic. Internally, it has been recommended in colica pictonum, in frequently repeated doses with or without opium and camphor; in chronic diarrhœa and dysentery, and in catarrhal affections of the stomach, in which there is hyper-secretion of glairy mucus and a relaxed condition of the mucous membrane; in passive hæmatemesis and hæmoptysis; in aneurism of the aorta; in dilatation of the heart; in chronic hooping-cough; as an emetic in croup; in gonorrhœa, combined with cubebs; in uterine hemorrhages, and in hæmaturia when the hemorrhage is from the bladder, &c. As a gargle, wash, or lotion, it has been used in relaxed states of the mucous membrane of the mouth and throat with profuse secretion of mucus, in ulcerations of the mouth and throat, and sponginess of the gums, &c.; as a collyrium in purulent ophthalmia; as an injection in ulcerations of, growths in, and hemorrhages and discharges from the vagina and uterus; in gonorrhœa, gleet, &c. Externally, it is applied either as a poultice, lotion, or the powder of burnt alum, to ulcers, chilblains, nævi, fungous granulations, gangrene, &c. In epistaxis it is injected into the nares; or plugs of lint, soaked in a saturated solution, are inserted; it is also applied as a hemostatic to leech bites, wounds, hemorrhoids, &c. By insufflation the powder of burnt alum is applied in diphtheria, inflammatory sore throat, &c.

CERIUM (Ce = 46 or 92).—Cerium is a rare metal, and its properties have not hitherto been well defined. It forms two oxides—a protoxide, CeO, and a sesquioxide, Ce_2O_3. The salts of the protoxide are colourless, or occasionally with a slight amethyst-red tinge; the salts of the sesquioxide are red. Of its salts, the oxalate, CeC_2O_4, and the nitrate, $Ce2NO_3$, besides the protoxide, are used in medicine. The salts of cerium are supposed to resemble bismuth and nitrate of silver in

their medicinal properties, and to act as sedatives and tonics. Only the oxalate, however, has been made officinal.

CERII OXALAS — ($2CeO,C_4O_6 + 6HO$, or $\mathbf{CeC_2O_43H_2O}$). The Oxalate of Cerium.

A salt which may be obtained as a precipitate by adding a solution of oxalate of ammonia to a soluble salt of cerium.

CHARACTERS.—*A white granular powder insoluble in water, decomposed at a dull red heat into a reddish-brown powder, which dissolves completely and without effervescence in boiling hydrochloric acid,*[1] *and the resulting solution gives with solution of sulphate of potash a white crystalline precipitate.*[2] *If the salt be boiled with solution of potash and filtered, the filtrate is not affected by solution of chloride of ammonium,*[3] *but when supersaturated with acetic acid, it gives with chloride of calcium a white precipitate, which is soluble in hydrochloric acid.*[4] 10 *grains when incinerated lose* 5·2 *grains in weight.*

[1] Absence of earthy carbonates. [2] The double sulphate of potassium and cerium, K_2Ce2SO_4. [3] Absence of Alumina. [4] Tests for oxalic acids.

Dose.—One to two grains, usually in the form of pill.

The oxalate of cerium is recommended by Sir James Y. Simpson in the treatment of vomiting during the earlier period of pregnancy, in the chronic vomiting attending irritable dyspepsia, and in the vomiting of phthisis; in epilepsy; chorea, &c. The nitrate is believed to have similar properties.

GROUP IV. METALS PROPER—MANGANESE, IRON, COPPER, ZINC, CADMIUM, BISMUTH, LEAD, TIN, ANTIMONY, ARSENIC, MERCURY, SILVER, GOLD, PLATINUM.

MANGANESIUM ($Mn = 27·5$ or 55). Manganese is a hard grey metal having a granular or subcrystalline fracture. It readily oxidises when exposed to the air, but may be preserved in naphtha. It decomposes water, uniting with the oxygen and evolving the hydrogen; when handled it emits a peculiar and disagreeable odour. With oxygen it forms five oxides and two acids: namely, MnO, protoxide; Mn_2O_3, sesquioxide; MnO_2, binoxide or peroxide; Mn_3O_4, red oxide or *Hausmannite;* Mn_4O_7, the mineral *Varricite;* MnO_3, manganic acid; and Mn_2O_7, permanganic acid. *Manganesii Protoxidum* (MnO)—Protoxide of Manganese, or Manganous Oxide—is of a dingy green colour, and when heated in air is converted into sesquioxide. It enters into most of the salts of manganese, which are colourless when pure, or of a slightly pinkish colour, are soluble in water, and resemble the salts of iron in some of their chemical and therapeutical properties, but, unlike them, they are compatible with vegetable astringents. *Manganesiæ Sulphas* ($MnSO_44H_2O$)—Sulphate of Manganese—Manganous Sulphate—may be obtained as in the process for procuring oxygen, by heating together black oxide of manganese and sulphuric acid, reducing the residue to powder, and again heating it with sulphuric acid. The sulphate thus

obtained is purified by solution and evaporation ; and in order to free it from the iron which it contains, its solution is treated with carbonate of manganese, whereby carbonate of iron is precipitated. The purified sulphate is then evaporated and crystallised. It occurs in pale rose-coloured crystals, which have a disagreeable styptic taste, and are readily soluble in water. The crystals contain from four to seven atoms of water, according to the temperature at which they are prepared. Hydrosulphate of ammonia gives a flesh-coloured precipitate, and ferrocyanide of potassium a white precipitate with a solution of this salt. Sulphate of manganese is said to operate upon the liver, increasing the secretion of bile, and acting as a cholagogue cathartic in large doses (grains 60 to 120), and as a tonic in small doses (grains 5 to 10). As a cathartic it is given in combination with other purgative medicines, as senna. Other salts of manganese are occasionally prescribed as substitutes for ferruginous tonics, such as—*Manganesiæ Carbonas,* which occurs as an insoluble white or pale rose-coloured powder, and is given in five-grain doses, either in simple powder, or in the saccharine form, in which it is more readily preserved, as it has a tendency to pass to a higher oxidation ; *Manganesiæ Phosphas,* which occurs as a white powder, almost insoluble in water, and is given in doses of two to five grains ; or along with phosphate of iron, dissolved in dilute phosphoric acid and made into a syrup, of which the dose is a teaspoonful ; *Manganesiæ Lactas,* which occurs in pale rose-coloured four-sided prismatic efflorescent crystals, is soluble in water, and is given in one-grain doses ; *Manganesiæ Acetas,* which occurs in white or rose-coloured prismatic crystals, has an astringent metallic taste, is soluble in water, permanent in air, and is given in doses of five grains ; and *Manganesii Chloridum,* which occurs in thick tabular rose-coloured soluble crystals, and is given in five-grain doses.

Manganesii Oxidum Nigrum (MnO_2). *Synonyms:* Black Oxide of Manganese—Magnesii Binoxidum—Peroxide of Manganese.

CHARACTERS.—*A heavy black powder, which dissolves almost entirely in hydrochloric acid with the evolution of chlorine,*[1] *and gives off oxygen when heated to redness.*[2] *Used for producing chlorine.*

[1] $MnO_2 + 4HCl = MnCl_2 + 2Cl$. [2] $3MnO_2$, when heated $= Mn_3O_4 + O_2$.

Besides being employed in the preparation of Cl, it is used in the arts for various purposes, as, for example, to prepare oxygen. It is liable to certain impurities, its freedom from which is known by the quantity of oxygen it yields on heating. In doses of ten grains it is sometimes used to allay vomiting.

Potassæ Permanganas (KO,Mn_2O_7, or $KMnO_4$)—Permanganate of Potash—Hypermanganate of Potash—Chameleon Mineral.

PREPARATION.—*Take of caustic potash,* 5 *ounces; black oxide of manganese, in fine powder,* 4 *ounces; chlorate of potash,* 3½ *ounces; diluted sulphuric acid, a sufficiency; distilled water,* 2½ *pints. Reduce the chlorate of potash to fine powder, and mix it with the oxide of manganese; put the mixture into a porcelain basin, and add to it the caustic potash, previously dissolved in four ounces of the water. Evaporate to dryness on a sand bath, stirring diligently to prevent spurting. Pulverise the mass, put it into a covered Hessian or Cornish crucible, and expose it to a dull red heat*

for an hour, or till it has assumed the condition of a semifused mass. Let it cool, pulverise it, and boil with a pint and a-half of the water. Let the insoluble matter subside, decant the fluid, boil again with half a pint of the water ; again decant, neutralise the united liquors accurately with the diluted sulphuric acid, and evaporate till a pellicle forms. Set aside to cool and crystallise. Drain the crystalline mass, boil it in six ounces of the water, and strain through a funnel the throat of which is lightly obstructed by a little asbestos. Let the fluid cool and crystallise, drain the crystals, and dry them by placing them under a bell jar over a vessel containing sulphuric acid.

Rationale.—In the first place, the chlorate of potash gives an equivalent of oxygen to the black oxide of manganese (MnO_2), thereby forming manganic acid ((MnO_3), which, combining with the caustic potash, produces manganate of potash (K_2MnO_4) ; and this again, by the boiling, passing from green, through blue, to a deep amethyst-red colour, is reconstructed into peroxide of manganese, caustic potash, and permanganate of potash ; ($3K_2MnO_4 = MnO_2 + 2K_2O + 2KMnO_4$). The peroxide of manganese is deposited, and the decanted fluid contains the permanganate of potash and the caustic potash. By neutralising with sulphuric acid, the caustic potash is converted into sulphate, which is crystallised out along with the permanganate. The two salts are boiled together, and are then separated by means of the filter which retains the somewhat less soluble sulphate, and is constructed of asbestos because the permanganate is decomposed by organic substances. The sulphuric acid in the bell jar absorbs the moisture from the permanganate.

Characters.—*Dark purple slender prismatic crystals, inodorous, with a sweet astringent taste, soluble in water. A single small crystal suffices to form, with an ounce of water, a rich purple solution, which, when mixed with a little rectified spirit and heated, becomes yellowish brown. The crystals heated to redness decrepitate, evolve oxygen gas, and leave a black residue from which water extracts potash, recognised by its alkaline reaction, and by its giving, when acidulated with hydrochloric acid, a yellow precipitate with perchloride of platinum.*

The readiness with which this salt yields its oxygen is its chief peculiarity and the cause of its medicinal value. When brought into contact with organic matter and deoxidising agents generally, it gives up a portion of its oxygen, loses its brilliant colour, and is converted into the yellowish-brown hydrated peroxide of manganese, referred to in the *characters.* A standard solution of the permanganate is used to determine the quantity of organic matter present in air and water, the quantity being in direct proportion to the loss of colour. The permanganate has been largely introduced as a deodoriser and disinfectant, under the title of *Condy's Disinfecting Fluid,* and *Condy's Ozonised Water.*

Purity Tests.—*Entirely soluble in cold water. Five grains dissolved in water require for complete decoloration a solution of forty-four grains of granulated sulphate of iron acidulated with two fluid drachms of diluted sulphuric acid.*

LIQUOR POTASSÆ PERMANGANATIS—Solution of Permanganate of Potash.—*Take of permanganate of potash,* 80 *grains; distilled water, one pint. Dissolve.*

Dose.—One to five grains, simply dissolved in distilled water, so as to avoid decomposition by organic matters, or two to four fluid-drachms of the Liquor. Externally as a caustic application, the powder may be sprinkled over sores, or strong solutions may be applied; as a purifying lotion or gargle, two or more drachms of the officinal solution in eight or ten ounces of distilled water. For purifying apartments, water-closets, &c., *Condy's Disinfecting Fluid*, which is about twice as strong, though less pure, than the officinal solution, may be employed, exposed in open vessels, or sprinkled on the floor.

Permanganate of potash is chiefly used as an escharotic, disinfectant, antiseptic, and deodorising agent, for the cleansing of gangrenous, cancerous, and other foul ulcers and wounds; as a gargle and wash for the mouth and throat, in ulcerations with fetid discharges from these parts; as an injection in fetid discharges from the vagina, &c. It may be given internally as a deodoriser of the breath and sputa in cases of phthisis, gangrene of the lungs, &c.; and to purify the alvine dejections in dysentery, typhoid fever, &c. It is also extensively used as a deodoriser of sick rooms, water-closets, cesspools, &c. The only disease for the cure of which it has been administered internally is *diabetes*, in which it may be given in doses of two to four grains, in solution, three or four times daily.

FERRUM ($Fe=28$ or 56)—Iron—*Fer*—*Eisen*—the *Mars*, ♂, of the alchemists—was probably the first used of any of the minerals in medicine. It occurs largely both in the inorganic and organic worlds, both in the free state and combined in a variety of forms. Iron exists in the blood, and is believed to be an essential constituent of it, without which life could not be sustained; its presence in sufficient quantity being indicated by the ruddy appearance of the cheeks and lips in health, whilst a deficiency is marked by paleness and other symptoms of disease. As a remedy, iron is inert in the metallic state, and it is only when it is rendered soluble by oxidation and conversion into salts (either before its administration, or by the gastric fluid) that it becomes useful. The preparations of iron exercise a twofold action, one immediate or primary, the other secondary. Their immediate action, varying according to the preparations employed, and chiefly manifested by the per-salts, is generally stimulant and astringent of the parts to which they are applied; amongst other effects, moderately exciting and giving tone, or an increase of the power of vital cohesion, to the stomach, and thereby stimulating the appetite, and improving the digestion.

The preparations which produce this effect are contra-indicated in those cases in which there is irritability of the stomach with a tendency to constipation, both of which they would increase; but they are used advantageously in cases of hyper-secretions, passive hemorrhages, and the like. The secondary, the true chalybeate or hematinic, action of the ferruginous preparations, is manifested slowly, after the medicine has been given in moderate doses for a considerable time, and consists in the enrichment of the blood by the increase in the number of its red particles. The milder proto-salts are commonly used for this purpose, because their employment is usually indicated in the cases of delicate females and children, suffering from anæmia, scrofula, &c., whose stomachs are weak and irritable, and would not bear the stronger preparations. When employed in unsuitable cases, or when pushed too far, chalybeates are apt to cause uneasiness, by inordinately exciting the circulatory system, giving rise to general plethora, and a complaint on the part of the patient of fulness in the head, singing in the ears, throbbing in the temples, headache, and general feverish excitement; and when the astringent preparations are unduly exhibited, there may be uneasiness and pain in the stomach and bowels, possibly attended by vomiting and diarrhœa. Ferruginous preparations are contra-indicated in persons of plethoric habit of body, and in active inflammatory and hemorrhagic cases. They tend to constipation and to blacken the alvine evacuations, the latter of which circumstances, if unexplained, may cause uneasiness in the mind of the patient. When the ferruginous preparations are administered chiefly for the sake of their tonic and astringent properties, it is better to give them in moderate doses upon an empty stomach; but when given as chalybeates it is better to give them with food. Besides the conditions already adverted to, the ferruginous preparations are employed in dyspepsia, in heart disease, in affections of the urinary organs, liver, and spleen; in dropsies, in fevers, &c., the chief of which will be mentioned under the several preparations.

Ferrum—Iron. 1. Wrought-iron in the form of wire or nails free from oxide—Annealed Iron Wire—Binding Wire—Ferrum in Fila Tractum. 2. Ferri Limatura—Iron Filings—Iron Turnings. Iron filings may be procured from the blacksmith's shop; they may be obtained in a state of tolerable purity by means of a magnet, but even then they contain adherent impurities. The readiest method of procuring them uncontaminated is by filing a piece of clean wrought-iron over a sheet of paper. Iron-filings are rarely used internally; but were formerly given for the cases in which the soluble preparations are now commonly administered.

They have been recommended in poisoning by the soluble salts of copper and mercury; and as a mechanical anthelmintic.

Ferrum Redactum. *Synonyms:* Reduced Iron—Ferri Pulvis—Fer Réduit—Metallic Iron, with a variable amount of magnetic oxide of iron.

PREPARATION.—*Take of hydrated peroxide of iron,* 1 *ounce; zinc granulated, a sufficiency; sulphuric acid, a sufficiency; chloride of calcium, a sufficiency. Introduce the hydrated peroxide of iron into a gun-barrel, confining it to the middle part of the tube by plugs of asbestos. Pass the gun-barrel through a furnace, and when it has been raised to a strong red heat, cause it to be traversed by a stream of hydrogen gas developed by the action on the zinc of some of the sulphuric acid diluted with eight times its volume of water. The gas, before entering the gun-barrel, must be rendered quite dry by being made to pass first through the remainder of the sulphuric acid, and then through a tube eighteen inches long, packed with small fragments of the chloride of calcium. The farther end of the gun-barrel is to be connected by a cork with a bent tube dipping under water; and when the hydrogen is observed to pass through the water at the same rate that it bubbles through the sulphuric acid, the furnace is to be allowed to cool down to the temperature of the atmosphere, the current of hydrogen being still continued. The reduced iron is then to be withdrawn, and enclosed in a dry stoppered bottle.*

Rationale.—The hydrogen, generated by the action of the sulphuric acid upon the zinc, abstracts the oxygen from the peroxide, reducing it to metallic iron, thus: $Fe_2O_3 + 6H = 3H_2O + 2Fe$; and part of this iron is converted into magnetic oxide by the steam which is produced at the high temperature. Were the iron withdrawn before it was sufficiently cooled, it would immediately absorb oxygen and burst into flame.

CHARACTERS.—*A fine greyish-black powder, strongly attracted by the magnet, and exhibiting metallic streaks when rubbed with firm pressure in a mortar. It dissolves in hydrochloric acid with the evolution of hydrogen, and the solution gives a light-blue precipitate with the yellow prussiate of potash.*[1]

PURITY TESTS.—*Ten grains added to an aqueous solution of fifty grains of iodine and fifty grains of iodide of potassium, and digested in a small flask at a gentle heat, leave not more than five grains undissolved, which should be entirely soluble in hydrochloric acid.*[2]

[1] The hydrochloric acid converts the iron (that is, the reduced iron and the magnetic oxide which it contains) into protochloride, the presence of which is made evident by this test.[2] It should consist of pure iron, but fifty per cent. of magnetic oxide of iron is allowed for by the above test, and sometimes the magnetic oxide is completely substituted for it. It may also contain sulphide of iron as an impurity, derived from a subsulphate which is sometimes formed during the process; when this is present, it causes unpleasant eructations of sulphuretted hydrogen. Reduced iron is administered as a chalybeate in anæmia, chlorosis, scrofula, &c., in doses of from two to ten grains, in powder, pills, or electuary: it is readily soluble in the gastric fluids, is not astringent, and is suitable in cases of weak digestion.

Trochisci Ferri Redacti—Lozenges of Reduced Iron.

Preparation.—*Take of reduced iron,* 720 *grains; refined sugar, in powder,* 25 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water,* 1 *fluid ounce, or a sufficiency. Mix the iron, sugar, and gum, and add the mucilage and water to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot air-chamber with a moderate heat. Each lozenge contains* 1 *grain of reduced iron.*

Dose.—One to six lozenges occasionally.

An agreeable form of administering iron.

Ferri Peroxidum Hydratum (Fe_2O_3HO or $Fe_2O_3H_2O$)—Hydrated peroxide of iron. *Synonym:* Ferri Peroxidum, British Pharmacopœia, 1864. Ferri Sesquioxidum, Lond. Ferrugo and Ferri Oxidum Rubrum, Edin.—Peroxide of Iron. Sesquioxide of Iron. Rouge. Colcothar. Crocus Martis. Peroxide de Fer. Rothes Eisenoxyd.

Preparation.—*Take of moist peroxide of iron,* 1 *pound. Dry it at a temperature not exceeding* 212°, *until it ceases to lose weight. Then reduce it to fine powder.*

By this process all but one atom of the water of the hydrated peroxide is driven off.

Characters.—*A reddish-brown powder, destitute of taste, and not magnetic, it dissolves completely, though slowly, with the aid of heat in hydrochloric acid diluted with half its volume of water, and the solution gives a copious precipitate with the yellow,*[1] *but none with the red prussiate of potash.*[2] *Heated to dull redness in a test tube, it gives off moisture.*

Preparation.—*Emplastrum Ferri.*

[1] The precipitate is dark blue, and is characteristic of a persalt of iron, the peroxide being converted into perchloride by the hydrochloric acid. [2] Absence of protoxide of iron.

EMPLASTRUM FERRI—Chalybeate Plaster—Emplastrum Roborans.—*Take of hydrated peroxide of iron, in fine powder,* 1 *ounce; Burgundy pitch,* 2 *ounces; lead plaster,* 8 *ounces. Add the peroxide of iron to the Burgundy pitch and lead plaster, previously melted together, and stir the mixture constantly till it stiffens on cooling.*

Dose.—Twenty to sixty grains, or more, in powder or electuary; it may be given in the cases in which ferruginous tonics and chalybeates are indicated, but its use is chiefly confined to the treatment of neuralgia, especially tic-douloureux. The plaster is employed in lumbago, rheumatic pains, weak joints, &c., as a mechanical support, and to afford warmth.

Ferri Peroxidum Humidum.—Moist peroxide of iron. *Synonym:* Ferri Peroxidum Hydratum, 1864. Hydrated peroxide of iron, with about 86 per cent. of uncombined water.

Preparation.—*Take of solution of persulphate of iron,* 4 *fluid ounces; solution of soda,* 33 *fluid ounces; distilled water, a sufficiency. Mix the solution of persulphate of iron with a pint of the distilled water, and add this gradually to the solution of soda, stirring them constantly and briskly.*

Let the mixture stand for two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away, wash the precipitate with distilled water, until what passes through the filter ceases to give a precipitate with chloride of barium. Lastly, enclose the precipitate without drying it in a stoppered bottle, or other suitable vessel, from which evaporation cannot take place. This preparation, when used, should be recently made.

Rationale.—Hydrated peroxide of iron is precipitated, and sulphate of soda remains in solution; thus $Fe_2 3SO_4 + 6NaHO = 3Na_2SO_4 + Fe_2O_3 3H_2O$; when the washings no longer precipitate with chloride of barium, the peroxide is free from sulphate.

CHARACTERS.—*A soft, moist, pasty mass, of a reddish-brown colour. Dissolves readily in diluted hydrochloric acid without the aid of heat, and the solution gives a copious blue precipitate with the yellow, but not with the red prussiate of potash.*[1] *A little of it dried at* 212°, *until it ceases to lose weight, gives off moisture when heated to dull redness in a test tube.*[2]

[1] The precipitate is dark blue, and is characteristic of a persalt of iron, the peroxide being converted into perchloride by the hydrochloric acid.
[2] Ultimately leaving the anhydrous peroxide. It spoils by keeping, assuming a crystalline form. It is not decomposed by drying, but it is thereby rendered useless as an antidote, and is therefore directed to be kept as a magma. Hydrated peroxide of iron is seldom given as a chalybeate, but may be substituted for the dried peroxide in doses of ten to thirty grains, or more. Its chief use is as an antidote in cases of arsenical poisoning. It must be given in large doses (a table-spoonful every few minutes), at least to the extent of twelve times the amount of the poison that has been swallowed; and as it only takes effect upon arsenic in solution, it is essential to continue the antidote so long as there is any possibility of there being any undissolved poison in the stomach. It should be freshly made; and when the materials for the above process are not at hand, the antidote may be expeditiously prepared by pouring the solution or tincture of perchloride of iron into solution of ammonia, potash, or soda, and filtering and washing the precipitate; or by the process recommended by Messrs T. & H. Smith (*see* Arsenious Acid, *passim*).

Ferri Oxidum Magneticum. *Synonyms:* Magnetic Oxide of Iron—Ferri Oxidum Nigrum—Black Oxide of Iron—Æthiops Martialis—Oxide de Fer Noir—Eisen Mohr—Schwarzes Eisen Oxydul—Fe_3O_4, combined with about 20 per cent. of water of hydration, and containing some peroxide of iron.

PREPARATION.—*Take of solution of persulphate of iron,* 5½ *fluid ounces; sulphate of iron,* 2 *ounces; solution of soda,* 4 *pints; distilled water, a sufficiency. Dissolve the sulphate of iron in two pints of the water, and add to it the solution of persulphate of iron, then mix this with the solution of soda, stirring them well together. Boil the mixture, let it stand for two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away, wash the precipitate with distilled water, until what passes through the filter ceases to give a precipitate with chloride of barium. Lastly, dry the precipitate at a temperature not exceeding* 120°.

Rationale.—When the solution of soda is added to the mixed solutions of persulphate and protosulphate of iron, the following reaction takes place:—$Fe_23SO_4 + FeSO_4 + 4Na_2O = 4Na_2SO_4 + Fe_3O_4$. The absence of sulphate is made clear when chloride of barium ceases to give a precipitate.

CHARACTERS.—*Brownish-black, destitute of taste, strongly attracted by the magnet. It dissolves without effervescence in hydrochloric acid diluted with half its volume of water, and the solution thus obtained gives blue precipitates with the red*[1] *and yellow*[2] *prussiates of potash. When a small quantity is heated in a dry test-tube by the flame of a lamp, a deposit of moisture takes place in the cool part of the tube.*

PURITY TESTS.—*Twenty grains dissolved in hydrochloric acid continue to give a blue precipitate with the red prussiate of potash, until* 83 *grain-measures of the volumetric solution of bichromate of potash have been added.*[3]

[1 & 2] Showing the presence both of a persalt and of a protosalt of iron, the magnetic oxide being converted into a perchloride, and protochloride by the hydrochloric acid. [3] Showing that the proportions of peroxide and protoxide, constituting the magnetic oxide, are correct. If metallic iron were present as an impurity, hydrochloric acid would cause effervescence by the evolution of hydrogen.

Magnetic oxide of iron may be administered as a mild chalybeate, but it is generally superseded by the *Fer réduit. Dose*, from three to twenty grains in powder or electuary.

Ferri Perchloridi Liquor Fortior—Strong Solution of Perchloride of Iron—Perchloride (or Sesquichloride) of Iron, Fe_2Cl_6, in solution in water.

PREPARATION.—*Take of iron wire,* 2 *ounces; hydrochloric acid,* 12 *fluid ounces; nitric acid,* 9 *fluid drachms*; *distilled water,* 8 *fluid ounces. Mix eight fluid ounces of the hydrochloric acid with the distilled water, and in this dissolve the iron at a gentle heat. Filter the solution, add to it the remainder of the hydrochloric acid and the nitric acid, heat the mixture briskly, until, on the sudden evolution of red fumes, the liquid becomes of an orange-brown colour, then evaporate by the heat of a water bath until it is reduced to ten fluid ounces.*

Rationale.—In the first place, protochloride of iron ($FeCl_2$) is formed, hydrogen being at the same time evolved, whilst one-third part of the hydrochloric acid remains unchanged. Thus $3Fe + 9HCl = 3FeCl_2 + 3HCl + 6H$. On the addition of the nitric acid, oxygen is given to the hydrogen of the hydrochloric acid to form water, whilst its chlorine passes over to the protochloride to form perchloride, thus, $6FeCl_2 + 6HCl + 2HNO_3 = 3Fe_2Cl_6 + N_2O_2 + 4H_2O$.

CHARACTERS.—*An orange-brown solution, with a strong styptic taste; miscible with water and rectified spirit in all proportions. Diluted with water, it is precipitated white by nitrate of silver,*[1] *and blue by yellow prussiate of potash,*[2] *but not at all by red prussiate of potash.*[3]

PURITY TESTS.—*Specific gravity* 1·338. *A fluid drachm of it diluted with two fluid ounces of water gives, upon the addition of an excess of*

solution of ammonia, a reddish-brown precipitate, which, when well washed and incinerated, weighs 15·62 *grains.*[4]

[1] Characteristic of a chloride. [2] Characteristic of a persalt of iron, the precipitate being dark blue. [3] Showing the absence of a protosalt (protochloride). [4] The precipitate is peroxide of iron, the quantity indicating the proper percentage of iron in the preparation. By concentrating the solution, the perchloride may be obtained in crystals, which vary in form according to the quantity of water contained in them; they may be either in needle-shaped radiating tufts, or in larger tabular crystals; they are orange-yellow in colour, very deliquescent, and very soluble in water, as well as in alcohol and ether.

LIQUOR FERRI PERCHLORIDI, Solution of the Perchloride of Iron.

The same strength as tincture of perchloride of iron.

PREPARATION.—*Take of strong solution of perchloride of iron,* 5 *fluid ounces; distilled water,* 15 *fluid ounces. Mix.*

Dose.—Ten to thirty minims.

This preparation is cheaper, keeps very much better, and possesses all the medicinal virtues of the tincture. It ought, therefore, eventually to supersede the latter entirely.

TINCTURA FERRI PERCHLORIDI—TINCTURE OF PERCHLORIDE OF IRON. *Synonyms:* Tinctura Ferri Sesquichloridi—Tinctura Ferri Muriatis. *Take of strong solution of perchloride of iron,* 5 *fluid ounces; rectified spirit,* 15 *fluid ounces. Mix, and preserve in a stoppered bottle.* TEST—*Specific gravity* 0·992. *This tincture has about one-third of the strength of Tinctura Ferri Sesquichloridi,* Dub.

Dose.—Of the strong solution, two to ten drops well diluted; of the tincture, or the solution, ten to forty drops, well diluted with water or syrup. For injecting into aneurisms, varices, or nævi, solutions of various strengths (five to twenty grains to a drachm of distilled water) are employed. Both the solutions and the tincture of perchloride of iron act as powerful astringents, styptics, hemostatics, and tonics, and undiluted, as escharotics. In excessive doses the tincture has occasionally proved fatal, and frequently highly injurious, the symptoms and treatment resembling those of poisoning by hydrochloric acid. It has been criminally used to induce abortion. Liquor Ferri Perchloridi Fortior is rarely used internally, the tincture, which is one-fourth of its strength, being commonly employed. It has been proposed to treat aneurisms by injecting them with strong solutions of the perchloride of iron; but the practice is highly dangerous. Varicose veins, varicose ulcers, and nævi have been treated in a similar manner. As an escharotic and hemostatic, the strong solution is applied to ulcerated surfaces, hospital gangrene, ancerous and fungous ulcerations, uterine polypi, hemorrhoidal tumours, post-partum hemorrhage, &c., both to produce an alterative effect and to arrest bleeding. The *Tincture* is also used as a hemostatic, to arrest capillary hemorrhage, to stop the bleeding of leech bites, and that following the extraction of teeth; and, as a milder caustic, it is applied to simple and venereal warts, to ulcerated surfaces,

spongy granulations, ulcerated throat, diphtheria, &c. Internally, the tincture is one of the most powerful of the astringent preparations of iron, and is also somewhat of a diuretic ; it is employed rather as a tonic than as a chalybeate, for which latter purpose the milder protosalts of iron are preferable. It is used in relaxed and atonic states of the system when there is no irritability of the alimentary mucous membrane ; in the night-sweats and debility of phthisis ; in passive hemorrhages and mucous discharges from the genito-urinary organs, as in hæmaturia, leucorrhœa, gleet, &c. ; also in the affections of the urinary organs, as in irritable bladder, spasmodic retention, and in the incontinence of children. In erysipelas the tincture is given in doses of fifteen to twenty-five minims repeated every two or three hours. As a tonic and chalybeate it is given in chlorosis, anæmia, albuminuria, diabetes, &c. The bowels must be relieved from the constipation which it produces.

Ferri Pernitratis Liquor—Solution of Pernitrate (or Sesquinitrate) of iron—Pernitrate of iron ($Fe_2O_3,3NO_5$, or Fe_26NO_3), in solution in water.

PREPARATION.—*Take of fine iron wire, free from rust,* 1 *ounce ; nitric acid,* 4½ *fluid ounces ; distilled water, a sufficiency. Dilute the nitric acid with* 16 *ounces of the water, introduce the iron wire into the mixture, and leave them in contact until the metal is dissolved, taking care to moderate the action, should it become too violent, by the addition of a little more distilled water. Filter the solution, and add to it as much distilled water as will make its bulk one pint and a half.*

Rationale.—Two equivalents of nitric acid are required to oxidise two equivalents of iron, an atom of nitric oxide passing off ($2Fe + 2HNO_3 = Fe_2O_3 + N_2O_2 + H_2O$) ; six equivalents of nitric acid added to the peroxide thus formed constitute the officinal preparation ; therefore $Fe_2O_3 + 6HNO_3 = Fe_26NO_3 + 3H_2O$.

CHARACTERS.—*A clear solution of a reddish-brown colour, slightly acid and astringent to the taste ; gives a blue precipitate with the yellow prussiate of potash.*[1] *When to a little of it placed in a test tube half its volume of pure sulphuric acid is added, and then a solution of sulphate of iron is poured on, the whole assumes a dark-brown colour.*[2]

PURITY TESTS—*Specific gravity* 1·107. *One fluid drachm treated with an excess of solution of ammonia gives a precipitate which, when washed, dried, and incinerated, weighs* 2·6 *grains.*[3] *It gives no precipitate with the red prussiate of potash.*[4]

[1] Characteristic of a persalt of iron, the precipitate being dark blue. [2] Due to a mixture of persulphate of iron with nitric oxide gas, and proves the presence of nitric acid. [3] Peroxide of iron, indicating the presence of the right percentage of iron in the preparation. [4] Indicating the absence of a protosalt (protonitrate) of iron.

Dose.—Ten to forty minims, sufficiently diluted with water. Pernitrate of iron acts as a tonic, astringent, and escharotic. It is given in chronic diarrhœa and in dysentery, both by the stomach and as an injection with mucilage of starch : in the colliquative diarrhœa and sweating of phthisis ; in lienteric diarrhœa, in the diarrhœa of nervous, debilitated females ; in passive hemorrhages from the stomach, intestines

(especially if in the course of typhoid fever), uterus, urinary organs, or lungs, in chronic mucous discharges, &c.

Ferri Sulphas (FeO,SO_3+7HO, or $FeSO_47H_2O$). *Synonyms:* Sulphate of Iron—Ferrous Sulphate—Ferrum Vitriolatum—Ferrum Protoxidatum Sulphuricum—Sal Martis—Green Vitriol—Copperas—Sulfate de Fer—Eisenvitriol—Schwefelsaures Eisenoxydul. By a particular method of preparation, Ferri Sulphas Granulata—Granulated Sulphate of Iron.

Preparation.—1. *Of Ferri Sulphas: Take of iron wire, 4 ounces; sulphuric acid, 4 fluid ounces; distilled water, 1½ pint. Pour the water on the iron placed in a porcelain dish, add the sulphuric acid, and when the disengagement of gas has nearly ceased, boil for ten minutes. Filter now through paper, and, after the lapse of twenty-four hours, separate the crystals which have been deposited from the solution. Let these be dried on filtering paper placed on porous bricks, and preserved in a stoppered bottle.*

2. *Of Ferri Sulphas Granulata: Take of iron wire, 4 ounces; sulphuric acid, 4 fluid ounces; distilled water, 1½ pint; rectified spirit, 8 fluid ounces. Pour the water on the iron placed in a porcelain capsule, add the sulphuric acid, and when the disengagement of gas has nearly ceased, boil for ten minutes, and then filter the solution into a jar containing the spirit, stirring the mixture so that the salt shall separate in minute granular crystals. Let these, deprived by decantation of adhering liquid, be transferred on filtering paper to porous tiles, and dried by exposure to the atmosphere. They should be preserved in a stoppered bottle.*

Rationale.—The changes which take place are alike in both cases, namely—$Fe+H_2SO_4=H_2+FeSO_4$, the hydrogen being evolved. By filtering, the insoluble impurities incorporated with and adherent to the iron wire are removed. The granulated sulphate is obtained by filtering the solution into the spirit, in which the protosulphate of iron is insoluble, and is therefore solidified, and, by the constant stirring, is obtained in minute granular crystals. By this means the protosulphate is freed from any persulphate that might be present, the latter being soluble in the spirit, and from interstitial water, by which the crystals are readily oxidised. By exposure to air the protosulphate is converted into persulphate, and therefore it is directed to be kept in a stoppered bottle.

Characters.—*Of Ferri Sulphas: In oblique rhombic prisms, of a pale greenish blue colour and styptic taste; insoluble in rectified spirit,*[1] *soluble in water.*

Tests.—*The aqueous solution is clear, gives a white precipitate with chloride of barium,*[2] *a blue one with the red,*[3] *and a nearly white or light blue one with the yellow prussiate of potash.*[4] *It gives no precipitate with sulphuretted hydrogen.*[5]

Characters.—*Of Ferri Sulphas Granulata: In small granular crystals of a pale greenish blue colour. In other respects corresponds to characters and tests for sulphate of iron.*

[1] The persulphate is soluble in rectified spirit. [2] Characteristic of a sulphate. [3] Characteristic of a protosalt of iron. [4] Which, if a persalt

were present, would be dark blue. [5] Absence of metallic impurities. Copper, as an impurity, may be recognised by being deposited upon the blade of a knife immersed in an acidulated solution.

FERRI SULPHAS EXSICCATA—DRIED SULPHATE OF IRON.—(FeO,SO_3HO, or $FeSO_4H_2O$.)—*Take of sulphate of iron,* 4 *ounces. Expose it in a porcelain or iron dish to a heat commencing at* 212°, *but which may be finally raised to* 400°, *until aqueous vapour ceases to be given off. Reduce the residue to a fine powder, and preserve it in a stoppered bottle.* The sulphate loses six of its seven atoms of water by this process. The dried sulphate occurs as a yellowish-white powder, and is much less bulky than the sulphate.

Dose.—Of the sulphate, or granulated sulphate, one to five grains, in pill or solution; of the dried sulphate, half-a-grain to two or three grains.

Pilula Aloes et Ferri—Pill of Aloes and Iron.

PREPARATION.—*Take of sulphate of iron,* 1½ *ounce; Barbadoes aloes, in powder,* 2 *ounces; compound powder of cinnamon,* 3 *ounces; confection of roses,* 4 *ounces. Reduce the sulphate of iron to powder, rub it with the aloes and compound powder of cinnamon, and adding the confection, make the whole into a uniform mass.*

Dose.—Five to ten grains.

This mass contains twice as much aloes as the original preparation in the Edinburgh Pharmacopœia. The proportions of the other ingredients remain unaltered. It combines the purgative properties of the aloes with the chalybeate of the iron, the latter ingredient seeming to increase the action of the aloes. It is useful as an emmenagogue in atonic amenorrhœa and chlorosis, and as a purgative in anæmia in general.

Sulphate of iron in excessive doses may act as an irritant poison; and it has been used criminally to produce abortion; in large medicinal doses it may cause irritability of stomach. It acts as a tonic, astringent, hematinic, antiperiodic, hemostatic, &c., and is given in those cases in which both the tonic and true chalybeate effects of iron are required, as in anæmia, chlorosis, and general debility; in passive hemorrhages, profuse discharges, chronic diarrhœa, &c.; as an antiperiodic, it has been used in intermittent fevers, and in neuralgia; and it is given in enlargement of the spleen. Externally, in the form of lotion, the sprinkled powder, or ointment, it is applied to ulcerated surfaces, chronic ophthalmia, erysipelas, &c. As an injection, it is used in leucorrhœa, gleet, prolapse of the rectum, &c.

Liquor Ferri Persulphatis.—Solution of the Persulphate of iron. Solution of Ferric Sulphate.

PREPARATION.—*Take of sulphate of iron,* 8 *ounces; sulphuric acid and nitric acid, of each* 6 *fluid drachms; distilled water,* 12 *fluid ounces, or a sufficiency. Add the sulphuric acid to* 10 *ounces of the water, and dissolve the sulphate of iron in the mixture with the aid of heat. Mix the nitric acid with the remaining* 2 *ounces of the water, and add the dilute acid to the solution of sulphate of iron. Concentrate the whole by boiling, until,*

by the sudden disengagement of ruddy vapours, the liquid ceases to be black, and acquires a red colour. A drop of the solution is now to be tested with red prussiate of potash; and if a blue precipitate forms, a few additional drops of nitric acid should be added, and the boiling renewed, in order that the whole of the sulphate may be converted into persulphate of iron. When the solution is cold, make the quantity 11 *fluid ounces, by the addition, if necessary, of distilled water.*

Rationale.—The protosulphate of iron is converted into persulphate of iron by the combined action of the oxygen from the nitric acid and the free sulphuric acid. The nitric oxide resulting from the decomposition of the nitric acid produces the black colour by dissolving in the portion of the protosulphate which is still unchanged, and the ruddy fumes by changing into peroxide of nitrogen when it escapes into the air.

The presence of any remaining protosulphate after the nitric acid has been exhausted, is determined by the red prussiate test. The reaction in symbols is as follows:—

$$6FeSO_4 + 2HNO_3 + 3H_2SO_4 = 3Fe_2SO_{43} + N_2O_2 + 4H_2O.$$

CHARACTERS.—*A dense solution of a dark-red colour, inodorous and very astringent, miscible in all proportions with alcohol and water.*

TESTS.—*Diluted with ten volumes of water, it gives a white precipitate with chloride of barium,*[1] *and a blue precipitate with yellow,*[2] *but not with red prussiate of potash.*[3] *Specific gravity* 1·441. *One fluid drachm diluted with two ounces of distilled water gives, upon the adding of an excess of solution of ammonia, a precipitate which, when well washed and incinerated, weighs* 11·44 *grains.*[4]

[1] Presence of sulphuric acid. [2] Test for persalt of iron. [3] Absence of protosalt of iron. [4] Amount of sesquioxide of iron contained in one fluid drachm of the solution.

This preparation is not used internally, but is employed in forming the following compounds:—Ferri et Ammoniæ Citras; Ferri et Quiniæ Citras; Ferri Oxidum Magneticum; Ferri Peroxidum Humidum; Ferrum Tartaratum; Tinctura Ferri Acetatis.

Ferri Carbonas Saccharata—Saccharated Carbonate of Iron—Carbonate of Iron (FeO,CO_2, or $FeCO_3$) mixed with Peroxide of Iron and Sugar, and forming at least thirty-seven per cent. of the mixture.

PREPARATION.—*Take of sulphate of iron,* 2 *ounces; carbonate of ammonia,* 1¼ *ounce; boiling distilled water,* 2 *gallons; refined sugar,* 1 *ounce. Dissolve the sulphate of iron and the carbonate of ammonia each in half-a-gallon of the water, and mix the two solutions with brisk stirring in a deep cylindrical vessel, which is then to be covered as accurately as possible. Set the mixture by for twenty-four hours, and from the precipitate which has subsided, separate the supernatant solution by a siphon. Pour on the remainder of the water, stir well, and after subsidence, again remove the clear solution. Collect the resulting carbonate on a calico filter, and, having first subjected it to expression, rub it with the sugar in a porcelain mortar. Finally, dry the mixture at a temperature not exceeding* 212°.

Rationale.—The sulphate of iron becomes carbonate and is precipitated, whilst the carbonate of ammonia becomes sulphate, and is removed by the siphon—($FeSO_4 + (H_4N)_2CO_3 = (H_4N)_2SO_4 + FeCO_3$). The object of the sugar is to preserve the carbonate from decomposition, which it readily undergoes by drying and exposure to the atmosphere, becoming sesquioxide.

CHARACTERS.—*Small coherent lumps of a grey colour, with a sweet, very feeble chalybeate taste. Dissolves with effervescence in warm hydrochloric acid, diluted with half its volume of water.*

PURITY TESTS.—*This solution gives but a very slight precipitate with chloride of barium.*[1] *Twenty grains, dissolved in excess of hydrochloric acid, and diluted with water, continue to give a blue precipitate with the red prussiate of potash, until at least* 330 *grain-measures of the volumetric solution of bichromate of potash have been added.*[2]

[1] Indicating the presence of a small quantity of sulphate of soda.
[2] The precipitate would cease sooner if there were a deficiency of the carbonate.

MISTURA FERRI COMPOSITA—COMPOUND MIXTURE OF IRON—GRIFFITH'S MIXTURE.—*Take of sulphate of iron,* 25 *grains; carbonate of potash,* 30 *grains; myrrh and refined sugar, of each,* 60 *grains; spirit of nutmeg,* 4 *fluid drachms; rose water,* 9½ *fluid ounces. Reduce the myrrh to powder, add the carbonate of potash and sugar, and triturate them with a small quantity of the rose water, so as to form a thin paste; then gradually add more rose water and the spirit of nutmeg, continuing the trituration, and further addition of rose water, until about eight fluid ounces of a milky liquid is formed. Then add the sulphate of iron dissolved in the remainder of the rose water, mix them together thoroughly, and preserve the mixture as much as possible from contact with the air.*

Rationale.—The sulphate of iron becomes carbonate, whilst the carbonate of potash, except what is in excess, and which forms an emulsion with the myrrh, becomes sulphate: ($FeSO_4 + K_2CO_3 = FeCO_3 + K_2SO_4$). The mixture should have a dark-green colour, but is prone to become brownish, as the carbonate, by losing its carbonic acid and absorbing oxygen, becomes sesquioxide of iron. The object of the sugar is to preserve the carbonate.

PILULA FERRI CARBONATIS—PILL OF CARBONATE OF IRON.—*Take of saccharated carbonate of iron,* 1 *ounce; confection of roses,* ¼ *ounce. Beat them into a uniform mass.*

Dose.—Of the saccharated carbonate, in powder or electuary, five to thirty grains; of the compound mixture, an ounce to two ounces; of the pill, five to twenty grains.

Carbonate of iron acts as a mild non-astringent chalybeate, suitable for females and children. It resembles the peroxide in medicinal properties, and, like it, is useful in neuralgia. Griffith's mixture is largely used in anæmia, chlorosis, and amenorrhœa, in incipient phthisis, hectic fever, &c. The myrrh and nutmeg render it somewhat stimulant. Carbonate of iron, held in solution by excess of carbonic acid, is the chief

constituent of many chalybeate waters; on the escape of the dissolving carbonic acid, the carbonate is resolved into sesquioxide, which gives the ochry appearance to the soil in the vicinity of these springs.

Ferri Phosphas. *Synonyms:* Phosphate of Iron—Blue Phosphate of Iron—Phosphate of Iron ($3FeO, PO_5$, or $Fe_3P_2O_8$) partially oxidated.

PREPARATION.—*Take of sulphate of iron,* 3 *ounces; phosphate of soda,* $2\frac{1}{2}$ *ounces; acetate of soda,* 1 *ounce; boiling distilled water,* 4 *pints. Dissolve the sulphate of iron in one half of the water, and the phosphate and acetate of soda in the remaining half. Mix the two solutions, and, after careful stirring, transfer the precipitate to a calico filter, and wash it with hot distilled water, till the filtrate ceases to give a precipitate with chloride of barium. Finally, dry the precipitate at a temperature not exceeding* 120°.

Rationale. — The phosphate of iron being tribasic, three equivalents of sulphate of iron are required, from which the sulphuric acid is to be removed by means of soda. But the phosphate of soda contains only two equivalents of sodium, the third atom of base being constituted by hydrogen, therefore other two atoms of sodium are required to saturate the third atom of sulphuric acid, which, if left free, would prove injurious; this is provided for by the acetate, whereby two equivalents of acetic acid are set free, which are not prejudicial to the salt desired. Thus $2(Na_2HPO_4) + 2(NaC_2H_3O_2) + 3FeSO_4 = 3Na_2SO_4 + Fe_3P_2O_8 + 2HC_2H_3O_2$.

CHARACTERS. — *A slate-blue amorphous powder, insoluble in water, soluble in hydrochloric acid. The solution yields a precipitate with both the yellow and red prussiate of potash, that afforded by the latter being the more abundant,*[1] *and when treated with tartaric acid and an excess of ammonia, and subsequently with the solution of ammonio-sulphate of magnesia, lets fall a crystalline precipitate.*[2]

PURITY TEST.—*When the salt is digested in hydrochloric acid with a lamina of pure copper, a dark deposit does not form on the metal.*[3] *Twenty grains dissolved in hydrochloric acid continue to give a blue precipitate with red prussiate of potash until* 250 *grain-measures of the volumetric solution of bichromate of potash have been added.*[4]

[1] Showing that it is chiefly a protosalt, but that it also contains a higher oxide, which is converted into perchloride by the hydrochloric acid. [2] Of the ammonio-phosphate of magnesia. [3] Absence of arsenic. [4] Indicating 4·2 grains of iron.

SYRUPUS FERRI PHOSPHATIS — SYRUP OF PHOSPHATE OF IRON.—*Take of granulated sulphate of iron,* 224 *grains; phosphate of soda,* 200 *grains; acetate of soda,* 74 *grains; diluted phosphoric acid,* $5\frac{1}{2}$ *fluid ounces; refined sugar,* 8 *ounces; distilled water,* 8 *fluid ounces. Dissolve the sulphate of iron in four ounces of the water, and the phosphate and acetate of soda in the remainder; mix the two solutions, and, after careful stirring, transfer the precipitate to a calico filter, and wash it with distilled water, till the filtrate ceases to be affected by chloride of barium. Then press the precipitate strongly between folds of bibulous paper, and add to it the diluted phosphoric acid. As soon as the precipitate is dissolved, filter the solution, add the sugar, and dissolve without heat. The product*

should measure exactly twelve fluid ounces. It contains one grain of phosphate of iron, $3FeO,PO_5$, or $Fe_3P_2O_8$, *in 1 fluid drachm.*

Rationale.—Same as in *Ferri Phosphas,* heat being avoided, and the powder being dissolved in the diluted phosphoric acid.

Dose.—Of the powder, three to ten grains, in powder, or pill, or dissolved in diluted phosphoric acid, sufficiently diluted ; of the syrup, from twenty minims to a drachm, well diluted, each drachm containing one grain of phosphate of iron, and about half-a-drachm of diluted phosphoric acid.

Phosphate of iron has been recommended as a mild chalybeate, and is said to be useful, in consequence of its combination with phosphoric acid, in cases of anæmia, chlorosis, &c., in conjunction with scrofula and rickets ; in cases complicated with great nervous exhaustion and depression of spirits, and where there is a tendency to deposits of phosphates in the urine ; it has also been recommended in diabetes. Several phosphates have been used in medicine, and a variety of syrups have been prepared, such as syrup of the phosphate of iron and lime, syrup of the phosphate of iron and ammonia, syrup of pyrophosphate of iron, syrup of superphosphate of iron, &c. Parrish's compound syrup of phosphates contains, in a tea-spoonful, two and a-half grains of phosphate of lime, one grain of phosphate of iron, with parts of a grain of phosphates of soda and potash, in addition to free phosphoric and hydrochloric acids. This and the above syrups may be given in doses of from thirty drops to a tea-spoonful.

Ferrum Tartaratum ($KO,Fe_2O_3,C_8H_4O_{10}$, or $KFeC_4H_4O_7$).—Tartarated Iron. *Synonyms:* Tartrate of Iron and Potash—Ferri Potassio-Tartras—Ferrum Tartarizatum, Ed. and Dub.—Potassio-Tartrate of Iron—Kalium Oxidatum—Tartaricum Ferratum—Tartrate de Potasse et de Fer—Eisenweinstein.

PREPARATION.—*Take of solution of persulphate of iron,* 5½ *fluid ounces; solution of ammonia,* 10 *fluid ounces; acid tartrate of potash, in powder,* 2 *ounces; distilled water, a sufficiency. Mix the solution of ammonia with three pints of distilled water, and to this add gradually the solution of persulphate of iron, previously diluted with two pints of distilled water, stirring constantly and briskly. Let the mixture stand for two hours, stirring it occasionally; then put it on a calico filter, and when the liquid has drained away, wash the precipitate with distilled water until that which passes through the filter ceases to give a precipitate with chloride of barium. Mix the washed and drained precipitate intimately with the acid tartrate of potash in a porcelain dish, and let the mixture stand for twenty-four hours; then, having applied a gentle heat not exceeding* 140°, *add gradually a pint of distilled water, and stir constantly until nothing more will dissolve. Filter, evaporate, at a temperature not exceeding* 140°, *to the consistence of syrup, and dry it in thin layers, on flat porcelain or glass plates, in a drying-closet at* 120°. *Remove the dry salt in flakes, and keep it in stoppered bottles.*

Rationale.—The ammonia becomes sulphate, and remains in solution while the iron of the persulphate of iron is precipitated as peroxide. ($Fe_2 3SO_4 + 3(NH_4)_2O = 3(NH_4)_2SO_4 + Fe_2O_3$. The washing removes

adherent sulphate of ammonia from the precipitate, its absence being indicated by the barium test. When the precipitate is added to the acid tartrate of potash, the atom of basic hydrogen of the latter is replaced by the iron of the sesquioxide, thus $Fe_2O_3 + 2KHC_4H_4O_6 = 2(KFeC_4H_4O_7) + H_2O$.

CHARACTERS.—*Thin transparent scales of a deep garnet colour, slightly sweetish and astringent in taste, soluble in water, and sparingly soluble in spirit. The aqueous solution, when acidulated with hydrochloric acid, gives a copious blue precipitate with the yellow,*[1] *but none with the red*[2] *prussiate of potash. When the salt is boiled with a solution of soda, peroxide of iron separates, but no ammonia is evolved,*[3] *and the filtered solution, when slightly acidulated by acetic acid, gives, as it cools, a crystalline deposit.*[4]

PURITY TESTS.—*By incinerating fifty grains of it at a red heat, washing what is left with distilled water, and again incinerating, a residue of peroxide of iron is obtained, weighing* 15 *grains.*[5]

[1] Characteristic of a persalt of iron, the precipitate being *dark* blue. [2] Absence of a protosalt. [3] Distinguishing it from the tartrate of iron and ammonia. [4] Acid tartrate of potash. [5] Indicating the presence of a due percentage of peroxide of iron in the preparation.

VINUM FERRI—WINE OF IRON.—*Take of fine iron wire* (*about No.* 35), 1 *ounce; sherry,* 1 *pint. Macerate for thirty days in a closed vessel, the iron being almost but not quite wholly immersed in the wine, and the vessel frequently shaken and the stopper removed; then filter.*

Rationale.—The iron wire gets gradually oxidised, and the oxide, as it forms, is taken up by the acid tartrate of potash existing in the sherry. It is, therefore, essentially a diluted solution of tartarated iron. It doubtless contains various other salts of iron, such as malate, citrate, acetate.

Dose.—Of the salt, five to fifteen grains, in solution or electuary; of the wine, one to four fluid drachms.

Tartarated iron acts as a mild chalybeate and tonic, and somewhat as a diuretic. It is given to delicate females and children.

FERRI ET AMMONIÆ TARTRAS—Ammonio-Tartrate of Iron —has probably the same constitution as Ferrum Tartaratum, the ammonium (NH_4) replacing the potassium (K).

Dose.—Three to eight grains, as a mild, non-astringent chalybeate.

FERRI CITRAS.—Citrate of the protoxide, and citrate of the peroxide of iron, have both been employed in medicine, but the latter—the acid citrate of the sesquioxide, or ferric citrate—more commonly. It may be obtained by saturating recently-prepared hydrated sesquioxide of iron with a boiling solution of citric acid. It occurs in thin, transparent, garnet-coloured scales. It may be given in doses of two to ten grains; but it is almost entirely superseded by the citrate of iron and ammonia, which is often used under the name of citrate of iron. The ferric citrate, or percitrate, is incompatible with alkalies, a disadvantage from which the ammonia-citrate is free.

Ferri et Ammoniæ Citras ($Fe_2O_3,NH_4O,HO,C_{12}H_5O_{11}+2HO$, or $NH_4FeHC_6H_5O_8H_2O$).—Citrate of Iron and Ammonia—Ammonio-Citrate of Iron.

PREPARATION.—*Take of solution of persulphate of iron,* 8 *fluid ounces; solution of ammonia,* 19½ *fluid ounces; citric acid,* 4 *ounces; distilled water, a sufficiency. Mix fourteen fluid ounces of the solution of ammonia with two pints of distilled water, and to this add gradually the solution of persulphate of iron, previously diluted with two pints of distilled water, stirring them constantly and briskly. Let the mixture stand for two hours, stirring it occasionally; then put it on a calico filter, and when the liquid has drained away, wash the precipitate with distilled water until that which passes through the filter ceases to give a precipitate with chloride of barium. Dissolve the citric acid in eight ounces of distilled water, and, having applied the heat of a water bath, add the oxide of iron, previously well drained, and stir them together until the whole or nearly the whole of the oxide has dissolved. Let the solution cool; then add five and a half fluid ounces of solution of ammonia. Filter through flannel; evaporate to the consistence of syrup, and dry it in thin layers, on flat porcelain or glass plates, at a temperature not exceeding* 100°. *Remove the dry salt in flakes, and keep it in a stoppered bottle.*

Rationale.—The persulphate of iron becomes sesquioxide, and as such is precipitated, whilst the ammonia is converted into sulphate and remains in solution ($Fe_23SO_4+3(NH_4)_2O=Fe_2O_3+3(NH_4)_2SO_4$. The adherent sulphate of ammonia is washed from the precipitate, its absence being indicated by the barium test. When the citric acid is added to this, the peroxide of iron enters into union with it, the iron replacing one of the atoms of its basic hydrogen, while a second atom is replaced by ammonium from the ammonia subsequently added, thus: $Fe_2O_3+(NH_4)_2O+2\{H_3C_6H_5O_7\}=2\{NH_4FeHC_6H_5O_8\}+2H_2O$, supposing this to be the correct formula.

CHARACTERS.—*In thin transparent scales of a deep red colour, slightly sweetish and astringent in taste; it feebly reddens litmus paper; is soluble in water, but almost insoluble in rectified spirit. Heated with solution of potash, it evolves ammonia*[1] *and deposits peroxide of iron.*[2] *The alkaline solution from which the iron has separated does not, when slightly supersaturated with acetic acid, give any crystalline deposit.*[3]

PURITY TEST.—*When incinerated with exposure to air, it leaves not less than* 27 *per cent. of peroxide of iron,*[4] *which is not alkaline to litmus.*[5]

Characteristic of a double salt of ammonia[1] and iron.[2] [3] Distinguishing it from a tartrate. [4] Indicative of a proper proportion of iron. [5] Does not contain any fixed alkali.

Dose.—Three to eight grains, in solution.

Citrate of iron and ammonia acts as a mild non-astringent chalybeate, given to delicate females and children. The *Aqua Chalybeata* or *Chalybeate Champagne,* as it is also called, as manufactured by Messrs Bewley and Evans, consists of citrate of iron in solution, flavoured with orange peel, and charged with carbonic acid gas. A wine-glassful of this sparkling solution may be given as a dose.

Vinum Ferri Citratis—Wine of the Citrate of Iron.

PREPARATION.—*Take of citrate of iron and ammonia,* 160 *grains; orange wine,* 1 *pint; dissolve, and let the solution remain for three days in a closed vessel, shaking it occasionally; afterwards filter.*

An excellent chalybeate, much less likely to decompose than the Vinum Ferri.

Dose.—One to four fluid drachms.

FERRI ET QUINIÆ CITRAS—Citrate of Iron and Quinia—Citric Acid combined with Peroxide of Iron, Protoxide of Iron, and Quinia.

PREPARATION.—*Take of solution of persulphate of iron,* $4\frac{1}{2}$ *fluid ounces; sulphate of quinia,* 1 *ounce; diluted sulphuric acid,* 12 *fluid drachms; citric acid,* 3 *ounces; solution of ammonia, distilled water, of each a sufficiency. Mix eight fluid ounces of the solution of ammonia with two pints of distilled water, and to this add the solution of persulphate of iron, previously diluted with two pints of distilled water, stirring them constantly and briskly. Let the mixture stand for two hours, stirring it occasionally. Then put it on a calico filter, and when the liquid has drained away, wash the precipitate with distilled water until that which passes through the filter ceases to give a precipitate with chloride of barium. Mix the sulphate of quinia with eight ounces of distilled water, add the diluted sulphuric acid, and when the salt is dissolved, precipitate the quinia with a slight excess of solution of ammonia. Collect the precipitate on a filter, and wash it with a pint and a-half of distilled water. Dissolve the citric acid in five ounces of distilled water, and having applied the heat of a water-bath, add the oxide of iron previously well drained; stir them together, and when the oxide has dissolved, add the precipitated quinia, continuing the agitation until this also has dissolved. Let the solution cool, then add, in small quantities at a time, twelve fluid drachms of solution of ammonia, diluted with two fluid ounces of distilled water, stirring the solution briskly and allowing the quinia, which separates with each addition of ammonia, to dissolve before the next addition is made. Filter the solution evaporated to the consistence of a thin syrup, then dry it in thin layers on flat porcelain or glass plates, at a temperature of* 100°. *Remove the dry salt in flakes, and keep it in a stoppered bottle.*

Rationale.—The first section of these instructions is devoted to the production of peroxide of iron, the sulphuric acid having been appropriated by the ammonia to form the soluble sulphate, which is entirely removed by the washing, as is indicated by the barium test. In the second section, quinia is obtained from the sulphate by decomposing the salt by means of ammonia, quinia being precipitated and sulphate of ammonia left in solution, the quinia is freed from the sulphate by filtration and washing. In the third section, first the oxide of iron and then the quinia are united with the citric acid, and to this combination ammonia is finally added, as it is found to make the salt much more readily soluble. The salt is, strictly speaking, a citrate of iron, quinia, and ammonia. In the edition of 1864, this preparation contained no ammonia; but as it was generally necessary to add ammonia in dispensing it to secure solution, the alcali has been added. Besides being more soluble than the corresponding preparation in the last edition of the British

Pharmacopœia, it is darker in colour. As is evident from the tests, the iron exists both as peroxide and protoxide.

CHARACTERS.—*Thin scales of a greenish golden-yellow colour, somewhat deliquescent, and entirely soluble in cold water. The solution is very slightly acid, and is precipitated reddish-brown by solution of soda,*[1] *white by solution of ammonia,*[2] *blue by the yellow and red prussiates of potash,*[3] *white and greyish-black by tannic acid.*[4]

PURITY TESTS.—*Taste bitter as well as chalybeate.*[6] *When burned, with exposure to air, it leaves a residue which, when moistened with water, is not alkaline to test-paper.*[7] *Fifty grains dissolved in a fluid ounce of water, and treated with a slight excess of ammonia, give a white precipitate which, when collected on a filter and dried, weighs eight grains.*[8] *The precipitate is almost entirely soluble in pure ether,*[9] *and when burned leaves but a minute residue.*

Indicating that the compound is constituted of iron [1] and quinia [2]; indicating the presence of a persalt [3] and a protosalt [4] of iron, the precipitate being dark blue in both cases. [5] Tannate of iron. [6] Distinguishing it from the ammonia-citrate, and other double salts of iron. [7] Absence of fixed alcalies or alcaline earths. [8] Of quinia. [9] Cinchonia and quinidia would not be.

Dose.—Three to eight or ten grains. The citrate of iron and quinia acts in the double capacity of its united constituents, as a non-astringent chalybeate and tonic.

FERRI ET MAGNESIÆ CITRAS—Citrate of Iron and Magnesia—may be made by first precipitating the hydrated sesquioxide of iron, dissolving this by means of citric acid, and, lastly, saturating the citrate thus formed with carbonate of magnesia, and precipitating. It occurs in greenish-yellow scales, which are not deliquescent. Its dose and properties are similar to those of the double citrate of iron and ammonia.

FERRI ET STRYCHNIÆ CITRAS.—Citrates of Iron and Strychnia have been prepared of different strengths; they usually contain from one to two per cent. of strychnia, and may be given in doses of two grains and upwards, in cases in which the double action of iron and strychnia is demanded.

FERRI ET ZINCI CITRAS.—The double citrate of iron and zinc may be given in doses of two grains and upwards, in cases in which the double action of iron and zinc is demanded.

FERRI AMMONIO-CHLORIDUM—Ammonio-Chloride of Iron—Ferrum Ammoniatum—Flores Martiales—may be prepared by first digesting sesquioxide of iron in hydrochloric acid, and then adding chloride of ammonium, the product to be drained, evaporated to dryness, and powdered. It occurs as an orange-yellow, subcrystalline inodorous powder, with an astringent saline taste; it deliquesces in air, and is readily soluble in water and alcohol. A tincture (Tinctura Ferri Ammonio-Chloridi) is made by dissolving four ounces of the compound in a mixture of half-a-pint each of proof spirit and water.

Dose.—Of the powder, three to ten grains, or more; of the tincture, ten to thirty minims, or more. The chloride of ammonium constitutes this a deobstruent as well as a tonic. It was formerly a good deal used as a mild chalybeate, alterative, and deobstruent; in large doses it acts as a cathartic. The chief objection to its use is its instability.

FERRI ET MANGANESII.—Preparations containing iron and manganese have been employed. A syrup of the phosphate of iron and manganese, in tea-spoonful doses, is at once a most pleasant and useful chalybeate and tonic; a syrup of the iodide of iron and manganese, in doses of ten to thirty minims; and a saccharated carbonate of iron and manganese, in doses of three to fifteen grains, or more, are prescribed as chalybeates and tonics.

FERRI ACETAS.—Proto-acetate of iron occurs in white silky crystals, the peracetate as a deep red non-crystallisable solution. The pharmacopœia contains the following preparation of the peracetate:—

Tinctura Ferri Acetatis.—Tincture of the Acetate of Iron.

PREPARATION.—*Take of solution of persulphate of iron, 2½ fluid ounces; acetate of potash, 2 ounces; rectified spirit, a sufficiency. Dissolve the acetate of potash in ten fluid ounces, and add the persulphate of iron to eight fluid ounces of the spirit, then mix the two solutions in a two-pint bottle and shake them well together, repeating the agitation several times during an hour. Put the tincture, with the precipitated salt contained in it, upon a filter, and when the liquid has ceased to run through, put as much rectified spirit upon the filter as will make the filtered product measure one pint.*

Rationale.—The persulphate of iron is decomposed by the acetate of potash forming sulphate of potash and per-acetate of iron ($Fe_2 3SO_4$ $6(K,C_2H_3O_2) = 3K_2SO_4 + Fe_2 6C_2H_4O_2$). The sulphate of potash, being insoluble in spirit, is precipitated and separated from the per-acetate of iron by filtration. There is excess of acetate of potash, which remains in solution. This preparation is very unstable.

A ferruginous tonic and chalybeate. It is introduced from the Dublin Pharmacopœia. It is questionable whether its special merits are such as entitle it to a place in the Pharmacopœia, which is already so rich in chalybeate preparations.

Dose.—Five to thirty minims.

FERRI LACTAS—Lactate of Iron—Lactate of the Protoxide of Iron may be prepared by acting upon clean iron filings with a dilute solution of lactic acid; or by a double decomposition between protosulphate of iron and lactate of lime, the latter being obtained by treating sour whey, previously evaporated to a third or a fourth of its volume, with milk of lime. Lactate of iron occurs either as a pale-green, or greenish-white powder, or in greenish acicular crystals. In solution it turns yellow in consequence of the iron passing to a higher state of oxidation. It is a mild preparation of iron, suitable in anæmic amenhorrhœa, &c.

Dose—Two to five grains, in syrup, or in lozenges.

FERRI TANNAS—Tannate of Iron—is formed whenever a sesquisalt of iron, unless it be highly acid, is brought into contact with tannic acid, whether free or contained in a vegetable substance. Hence, ferruginous preparations are generally said to be incompatible with tannic acid and substances containing it. Nevertheless, the tannate itself has been given with advantage in doses of five to ten grains, or more, as a mild chalybeate. The following officinal preparation consists essentially of tannate of iron.

Mistura Ferri Aromatica—Aromatic Mixture of Iron.

PREPARATION.—*Take of pale cinchona bark, in powder,* 1 *ounce; calumba root, in coarse powder,* ½ *ounce; cloves, bruised,* ¼ *ounce; fine iron wire,* ½ *ounce; compound tincture of cardamoms,* 3 *fluid ounces; tincture of orange peel,* ½ *fluid ounce; peppermint water, a sufficiency. Macerate the cinchona bark, calumba root, cloves, and iron, with twelve fluid ounces of the peppermint water, in a closed vessel for three days, agitating occasionally; then filter the liquid, adding as much peppermint water to the filter as will make the product measure twelve and a-half fluid ounces: to this add the tinctures, and preserve the mixture in a well-stoppered bottle.*

Dose.—One to two fluid ounces.

This is a somewhat unchemical and unsightly preparation, but enjoys a great reputation in Dublin as an excellent tonic and chalybeate. From the name of its author, as well as on account of its appearance, it is sometimes called Heberden's Ink.

FERRI VALERIANAS—Valerianate of Iron—may be prepared by acting upon valerianate of soda with persulphate of iron. It occurs as a dark dull-red amorphous powder, having the disagreeable odour and somewhat the taste of valerianic acid. It is soluble in alcohol, insoluble in cold water, and is decomposed by boiling water. It is quickly spoiled by exposure to the air, the valerianic acid escaping, and peroxide of iron remaining, and is therefore difficult to preserve, and is of uncertain constitution. It must be kept in a well-stoppered bottle. Other preparations of iron, to which valerianic acid is added to impart the necessary odour, are sometimes substituted for the real salt. Valerianate of iron is given, in doses of half-a-grain to a grain, in cases of chlorosis, &c., complicated with hysteria.

FERRI SULPHURETUM—Iron Pyrites—Sulphuret or Sulphide of Iron.—The sulphuret of iron mentioned in the Appendix of the Pharmacopœia is the protosulphuret (FeS), but there are several compounds of iron and sulphur, the most common of which is the native bisulphuret, iron pyrites, or mundic. The protosulphuret, for pharmaceutical purposes, may be prepared by fusing together in a crucible, iron filings and sublimed sulphur, or by rubbing a roll of sulphur upon a rod of iron heated to whiteness, and allowing the fused globules to fall into a vessel of water. Sulphuret of iron is chiefly used for the preparation of sulphuretted hydrogen, but it has also been proposed as a stimulating alterative in scrofulous and chronic cutaneous diseases, and as an antidote in cases of poisoning by corrosive sublimate, arsenic, lead, and other metals;

the object being, by the aid of the acids in the stomach, to develop hydrosulphuric acid, but it is to be borne in mind that this is itself a poison, and therefore the sulphuret should be used with caution.

YELLOW PRUSSIATE OF POTASH—($K_2FeC_6N_3 + 3HO$ or $K_4Fe C_6N_63H_2O$). *Synonyms:* Ferrocyanide of Potassium—Ferrocyanate of Potash. This salt occurs in large quadrangular, lemon-yellow coloured transparent crystals, which are inodorous, and have a cooling saline taste. The salt is readily soluble in cold and boiling water, but is insoluble in alcohol. It is used in the preparation of diluted hydrocyanic acid, and as a test for persalts of iron, with which it gives a deep blue precipitate (*Prussian Blue*), whilst with protosalts it gives a bluish-white precipitate, which becomes darker on exposure to the air, or to oxygen or chlorine. Medicinally, it has been recommended as a sedative in doses of ten to fifteen grains, but even in much larger doses it seems to be nearly inert and is rarely used.

RED PRUSSIATE OF POTASH—($K_3Fe_2C_{12}N_6$ or $K_6Fe_2C_{12}N_{12}$). *Synonym:* Ferridcyanide of Potassium. It occurs in ruby coloured rhombic prismatic crystals, which are soluble in water; it is used as a test for protosalts of iron, with which it gives a dark blue precipitate, whilst with persalts it gives a deep reddish-brown colour, but no precipitate.

CUPRUM (Cu = 32 or 64)—Copper—Cuivre—Kupfer—the *Venus*, ♀, of the alchemists—was known in the early ages. Copper, which derives its name from the island of Cyprus, or *Κύπρος*, where it was first wrought by the Greeks, occurs both in the inorganic and the organic world; in the latter it is found in the ashes of many plants, and in the former it is met with in various states of combination, especially in the form of sulphides, from which the copper of commerce is chiefly derived. Fine copper wire is contained in the Pharmacopœia, and copper foil—pure metallic copper, thin and bright—is placed in the Appendix. It is a red lustrous metal, malleable and ductile; it emits a peculiar odour when warmed or rubbed, and has an average specific gravity of 8·873. Copper in the metallic state is probably inert in the system, but when rendered soluble, either by previous preparation or by the action of the gastric fluid, it operates in large quantity as an irritant poison, and even in smaller doses it causes considerable gastro-intestinal irritation. Hence, the soluble salts of copper in over-doses are poisonous, whilst in medicinal quantities they are chiefly tonics and astringents, and also alteratives and antispasmodics. Copper is employed in the preparation of the sulphate of copper and of spirit of nitrous ether, as a test (Reinsch's) for arsenic, for the reduction of mercury, for the detection of silver, as a purity test for hydrochloric acid, &c.

Cupri Sulphas ($CuO,SO_3 + 5HO$ or $CuSO_45H_2O$). *Synonyms:* Sulphate of Copper—Cupric Sulphate—Cuprum Oxidatum Sulphuricum—Blue Stone—Blue Vitriol—Sulfate de Cuivre—Kupfer-Vitriol.

PREPARATION.—*May be obtained by heating sulphuric acid and copper together, dissolving the soluble product in hot water, and evaporating the solution until crystallisation takes place on cooling.*

CHARACTERS.—*A blue crystalline salt, in oblique prisms, soluble in water, forming a pale blue solution which strongly reddens litmus. The aqueous solution gives with chloride of barium a white precipitate insoluble in hydrochloric acid,*[1] *and a maroon-red precipitate with yellow prussiate of potash.*[2]

[1] Characteristic of a sulphate. [2] Ferrocyanide of copper (Cu_2FeCy_6). The crystals are slightly efflorescent in dry air, and receive a white coating; they are inodorous, and have a nauseous styptic metallic taste. At a temperature of 212° it loses four atoms of water of crystallisation, and falls down into a pale blue powder; and when heated to 400° it is deprived of the rest of its water, and forms the *anhydrous sulphate of copper*, $CuSO_4$, mentioned in the Appendix of the Pharmacopœia as a yellowish-white powder, which becomes blue when moistened with water. A piece of polished steel, such as the blade of a knife, when immersed in an acid solution of sulphate of copper, receives a red coating of metallic copper.

PURITY TESTS.—*If an aqueous solution of the salt be mixed with twice its volume of solution of chlorine, and solution of ammonia be added, the precipitate formed by the first addition of the ammonia will be dissolved by a further and sufficient addition of the alkali, and a violet-blue solution will be produced, leaving nothing undissolved.*[1]

[1] The chlorine, by abstracting hydrogen from the water, liberates oxygen, whereby any iron that may be present, and for the detection of which the test is intended, is peroxidised and precipitated; the copper also is precipitated as an oxide, but is redissolved by the ammonia, whilst the iron remains behind. If zinc be present as an impurity, it may be detected by dissolving the salt in nitric acid, decomposing the solution with caustic potash, clearing it by filtration, and adding to the filtrate a little hydrosulphuret of ammonia, which will cause a white precipitate of sulphide of zinc.

Dose.—As an astringent and tonic, a quarter of a grain to two grains, in pill or solution; as an emetic, three to ten or fifteen grains, in solution; as a collyrium, one or two grains to an ounce of rose water; as an injection, two to five grains to an ounce of water; as a lotion, two to ten grains to an ounce of water.

Antidotes.—Albumen, as in the white of egg, in considerable quantity; the yolk may also be given; wheaten flour; sugar; iron filings or fer réduit; favour vomiting by abundance of warm water, milk, or mucilaginous drinks. The stomach-pump may be used, if necessary, but with care, and it is useless if the poison be in the solid form. Subsequent symptoms to be treated as they arise.

Sulphate of copper in over-doses acts as an irritant poison, and as such it has been used for criminal purposes. Poisoning may take place either rapidly by a large dose, or more slowly by small and long-continued doses. The symptoms of acute poisoning are divisible into two classes; *first*, those proceeding from the immediate or topical effects of the drug; and, *second*, those arising after its absorption. The primary symptoms are developed within a few

minutes of the swallowing of the poison; there is a nauseating, metallic, styptic taste, constriction of the throat and œsophagus, burning and colicky pains in the stomach and bowels, with painful distension of the abdomen and tenesmus; there is usually violent vomiting, and there may be diarrhœa, the vomited matters being of a blue or green colour, and the alvine evacuations sometimes greenish, and at other times darker coloured, with an admixture of blood. There is intolerance of pressure upon the abdomen; the urine is frequently suppressed, and occasionally jaundice has supervened. The secondary symptoms are occasioned by the effects of the poison upon the nervous system; there is general prostration of strength; the pulse is small, weak, frequent, and often irregular; the extremities are cold and trembling, and the face and body are bathed in a cold perspiration; the breathing is hurried and sighing; the patient suffers from intense thirst, headache, and cramps, and gradually sinks into a state of stupor, with or without convulsive attacks. Chronic poisoning by sulphate of copper, or by other preparations of copper, is manifested by the peculiar metallic styptic taste, hot skin, or alternations of heat and cold, thirst, loss of appetite, weariness, gradual emaciation, irritability of stomach, with nausea, and occasionally vomiting of greenish matters, colicky pains in the abdomen, which is intolerant of pressure, tremblings of the limbs and cramps, diarrhœa, with greenish evacuations, which are occasionally mixed with blood, a small pulse, nervous prostration, a tendency to paralysis, occasionally jaundice, &c. There is said to be also a characteristic purple line round the gums. Chronic poisoning by copper may occur from the use of copper vessels in the preparation of food; this, however, cannot take place when they are kept clean, but when allowed to stand with acidulous or fatty substances in them the copper is dissolved, and, being oxidised by the atmosphere, becomes poisonous. Medicinally, sulphate of copper acts as an astringent and tonic; as a stimulant of the nervous system; as an emetic; as a styptic; and as an escharotic. It has been recommended in chronic dysentery and diarrhœa, in the diarrhœa of phthisis, and in that attending ulceration of the bowels; it is given in small doses in combination with small quantities of opium; and in doses of one-twelfth of a grain it has been given in the chronic diarrhœa of infants. In epilepsy, chorea, hysteria, &c., it has been given in small doses long continued. In croup it has been used both as an astringent and emetic. As an emetic it acts promptly, and without causing depression of the vital powers; when given in

large doses for this purpose, and not ejected, its removal should be insisted upon by other means of producing vomiting, so as to avoid its irritating effects. As a wash, or in the form of a honey, it is applied to ulcerations of the mouth; as a gargle, to ulcerated sore throat; as an injection, it is used in leucorrhœa and gonorrhœa; as a collyrium, it is applied to purulent ophthalmia, &c.; as a lotion, to certain skin diseases; as an escharotic, it is applied to exuberant and unhealthy granulations, to indolent ulcers, to remove venereal warts, &c. As a styptic, it is occasionally applied to leech bites, superficial hemorrhages, in epistaxis, &c.

CUPRI AMMONIO-SULPHAS—Cuprum Ammoniatum—Ammonia-Sulphate of Copper—Ammonio-sulphate of copper may be prepared by rubbing together sulphate of copper and sesquicarbonate of ammonia, till carbonic acid ceases to be evolved, and finally rolling the mass thus obtained in bibulous paper and drying it in the air. It is usually met with as a deep azure-blue coloured crystalline powder, but it may be obtained in long flattened prisms or acicular crystals. The constitution of this compound is variously stated; it is most probably ($CuSO_4(H_4N)_2SO_4 6H_2O$); but Wittstein considers it to be a compound of sulphate of ammonia and ammoniated oxide of copper, which gives the formula—$\{(NH_4)_2SO_4+(NH_4)_2CuO\}$. It emits an ammoniacal odour, and has a nauseous metallic styptic taste. It is readily soluble in water, the solution turning turmeric brown, and when exposed to the air gives off an atom of ammonia, leaving a green powder. It must, therefore, be preserved in a well-stoppered bottle. Medicinally, this preparation is but little used; it is capable of producing, in over-doses, all the symptoms mentioned under poisoning by the sulphate, the treatment being the same. It acts as a tonic and antispasmodic, in doses of a quarter or half-a-grain up to four or five grains, and has been chiefly used in epilepsy and chorea; but also in the other cases mentioned under the sulphate.

CUPRI DIACETAS IMPURA—Cupri Subacetas—Commercial Subacetate of Copper—Ærugo—Verdigris—Vert de gris.—Commercial acetate of copper varies in constitution and appearance; it is met with in lumps or in powder, and of a bright blue (blue verdigris), or of a bluish-green (green verdigris) colour, the former being a hydrated dibasic acetate ($Cu2H_2C_3O_2,CuO6H_2O$), the latter being a mixture of the sesquibasic acetate and tribasic acetate, and the trisacetate. Verdigris is obtained by exposing plates of copper to the action of acetic acid, either by covering them with woollen cloths dipped in the acid, or by immersing them in heaps of grape stalks and husks, the refuse of the wine-press, undergoing the acetous fermentation. Neutral acetate of copper ($Cu2C_2H_3O_2$) may be obtained from verdigris by dissolving it in dilute acetic acid, when the trisacetate is deposited and the neutral acetate is left in solution. Verdigris has a somewhat acetous odour and a nauseous, metallic, styptic, coppery taste. It acts as an irritant poison, the symptoms and treatment being similar to those mentioned under the sulphate. It is not given internally; externally it is applied as an escharotic to venereal warts, fungous vegetations, foul and indolent

ulcers, chronic skin diseases of the scalp, &c. It may be applied in powder, liniment, or ointment. *Linimentum Æruginis*, or *Mel Egyptcum,* is prepared by dissolving an ounce of powdered verdigris in seven ounces of vinegar, straining and adding fourteen ounces of clarified honey, and lastly, boiling to a proper consistence ; it is applied with a camel's-hair brush to ulcers, ophthalmia tarsi, &c., or, diluted, it may be used as a gargle in ulcerations of the mouth, tonsils, or throat.

CUPRUM ALUMINATUM—Lapis Divinus—Pierre Divine—Lapis Ophthalmicus St Yves—Aluminated Copper—may be prepared by fusing together powdered sulphate of copper, nitrate of potash, and alum, of each three ounces, and then adding sixty grains of finely powdered camphor, pouring out the fused liquid upon a slab, and breaking it into pieces when solidified. It must be kept in well-stoppered bottles. It is used as an escharotic, chiefly in ophthalmic cases.

CUPRI CARBONAS ($CuOH_2OCuCO_3$)—Hydrated Subcarbonate of Copper—Mineral Green—may be obtained by acting upon a solution of sulphate of copper with carbonate of soda. The carbonate is precipitated as a pale green powder which is washed and dried. It occurs native as *Malachite.* The carbonate has been employed as an ointment applied to chronic cutaneous diseases of the scalp. It has also been used internally in neuralgia. The *black oxide of copper* (CuO), which may be obtained by heating the carbonate or nitrate to redness, has been used as a substitute for the carbonate or nitrate, and has been employed both internally and externally.

CUPRI NITRAS ($Cu2NO_36H_2O$)—Nitrate of Copper—may be prepared by dissolving copper wire in diluted nitric acid, and evaporating the solution. It forms prismatic crystals, which are of a deep blue colour, have a nauseous, styptic, metallic taste, and are extremely deliquescent. It is employed as a caustic to the deeply excavating lupoid and semi-phagedænic syphilitic ulcerations of the throat and genital organs, great care being taken to protect the surrounding parts. It has been used also in the form of weak injection in gonorrhœa, and has been given internally in doses of an eighth of a grain, dissolved in mucilage.

CUPRI CHLORIDUM ($CuCl_2$)—Chloride of Copper—may be obtained by dissolving copper wire in hydrochloric acid, and evaporating the solution. It forms green acicular crystals, and has been administered as an alterative in doses of the sixteenth of a grain, gradually increased.

ZINCUM ($Zn = 32{\cdot}5$ or 65) is a bluish-white lustrous and rather hard metal, commonly of the specific gravity 6·8. When moistened with the breath or handled with damp fingers, it emits a peculiar odour, and tarnishes in damp air. It is soluble in hydrochloric and sulphuric acids, and in strong-heated solutions of potash and soda, with the evolution of hydrogen. Metallic zinc may be obtained from the native sulphide or carbonate.

ZINCUM GRANULATUM — GRANULATED ZINC. — *Take of zinc of commerce,* 1 *pound; fuse it in an earthen crucible, heated to a sufficient but not excessive degree in a suitable fire, and pour the fused*

metal in a thin stream into a vessel containing two gallons of cold water. Remove the granulated zinc from the water, and dry it.

PURITY TESTS.—*The hydrogen gas evolved when the metal dissolves in diluted pure sulphuric acid does not blacken a piece of paper moistened with a solution of acetate of lead;*[1] *and when ignited gives no dark stain to the lid of a porcelain crucible held low down in the flame.*[2]

[1] Absence of sulphide of zinc. [2] Absence of arsenic. Granulated zinc is used in pharmacy.

Zinci Oxidum (ZnO). *Synonyms:* Oxide of Zinc—Flowers of Zinc—Lana Philosophica—Philosopher's Wool—Oxide de Zinc—Zynkoxyd. In the impure state, Tutty.

PREPARATION.—*Take of carbonate of zinc,* 6 *ounces. Place the carbonate of zinc in a loosely-covered Hessian crucible, and expose it to a dull red heat, until a portion, taken from the centre of the contents of the crucible and cooled, no longer effervesces when dropped into diluted sulphuric acid. Let the crucible cool, and transfer the product to stoppered bottles.*

Rationale.—By heat the carbonic acid is driven off from the carbonate, and that none remains is shown by the lack of effervescence when treated with sulphuric acid.

CHARACTERS.—*A soft, nearly white, tasteless and inodorous powder, becoming pale-yellow when heated.*[1]

PURITY TESTS.—*Dissolves without effervescence in diluted nitric acid;*[2] *forming a solution, which is not affected by chloride of barium,*[3] *or nitrate of silver,*[4] *and gives with carbonate of ammonia a white precipitate which dissolves entirely without colour in an excess of the reagent,*[5] *forming a solution which is precipitated white by sulphide of ammonium.*[6]

[1] But whitens again as it cools. [2] Absence of carbonate. [3] Absence of sulphates. [4] Absence of chlorides. [5] Iron, if present, would be precipitated and not redissolved by the ammonia, and if the solution were not colourless, other impurities would be suspected, such as copper if it were blue. [6] Characteristic of zinc.

UNGUENTUM ZINCI—OINTMENT OF ZINC.—*Synonym:* Ointment of Oxide of Zinc. *Take of oxide of zinc,* 80 *grains; benzoated lard,* 1 *ounce. Add the oxide of zinc to the benzoated lard, previously melted with a gentle heat, and stir the mixture constantly while it cools.*

Dose.—Two to ten or more grains, in powder or pill.

Oxide of zinc is employed as a tonic, antispasmodic, and astringent. It is slow of action as a tonic, and must, therefore, be long continued. It has been given in epilepsy, chorea, neuralgia, intermittent fever, hooping-cough, and the convulsions of children, in gastrodynia, &c., as a tonic astringent in the colliquative sweats of phthisis. It is sometimes used as an injection in leucorrhœa and in gonorrhœa. As an astringent application, as a powder, or mixed with starch, or better, in the form of the ointment, it is applied to

sore nipples, excoriations, bed-sores, ophthalmia tarsi, and to a variety of skin diseases, especially those of an eczematous or impetiginous character after the acute symptoms have somewhat subsided.

Zinci Chloridum ($ZnCl$ or $ZnCl_2$)—Chloride of Zinc—Butter of Zinc.

PREPARATION.—*Take of granulated zinc, 16 ounces; hydrochloric acid, 44 fluid ounces; solution of chlorine, a sufficiency; carbonate of zinc, ½ ounce, or a sufficiency; distilled water, 1 pint. Put the zinc into a porcelain basin, add by degrees the hydrochloric acid previously mixed with the water, and aid the action by gently warming it on a sand bath until gas is no longer evolved. Boil for half-an-hour, supplying the water lost by evaporation, and allow it to stand on a cool part of a sand bath for twenty-four hours, stirring frequently. Filter the product into a gallon bottle, and pour in the solution of chlorine by degrees, with frequent agitation, until the fluid acquires a permanent odour of chlorine. Add the carbonate of zinc, in small quantities at a time, and with renewed agitation, until a brown sediment appears. Filter through paper into a porcelain basin, and evaporate until a portion of the liquid, withdrawn on the end of a glass rod and cooled, forms an opaque white solid. Pour it out now into proper moulds, and when the salt has solidified, but before it has cooled, place it in closely-stoppered bottles.*

Rationale.—In the first place chloride of zinc is formed and hydrogen evolved, thus ($Zn + 2HCl = ZnCl_2 + 2H$), and by the first filtration any insoluble impurities are removed. But the zinc almost invariably contains some iron, which is also converted into soluble chloride ($FeCl_2$), and is associated with the chloride of zinc; in order to get rid of this, the protochloride is first converted into perchloride, by the addition of chlorine, thus ($2FeCl_2 + Cl_2 = Fe_2Cl_6$), and then by the addition of the carbonate of zinc the iron is precipitated in the form of "a brown sediment" of peroxide, which is removed by filtration, and more chloride of zinc is obtained, thus—$Fe_2Cl_6 + ZnCO_3 + H_2O + 2ZnH_2O_2 = CO_2 + 3H_2O + Fe_2O_3 + 3ZnCl_2$. If lead be present, it is, by the same process, precipitated as peroxide: thus, $PbCl_2 + Cl_2 = PbCl_4$ and $PbCl_4 + 2ZnCO_3 = 2ZnCl_2 + PbO_2 + 2CO_2$.

CHARACTERS.—*Colourless opaque rods or tablets, very deliquescent and caustic; soluble almost entirely in water, alcohol, and ether. The watery solution is precipitated white by sulphide of ammonium*[1] *and nitrate of silver;*[2] *but, if first acidulated with hydrochloric acid, it is not affected by sulphuretted hydrogen.*[3]

PURITY TESTS.—*Its watery solution is not affected by chloride of barium*[4] *or oxalate of ammonia,*[5] *and is not tinged blue by the yellow*[6] *or red*[7] *prussiate of potash. Ammonia throws down a white precipitate entirely soluble in an excess of the reagent.*[8]

Characteristic of a salt of zinc[1] and of a chloride.[2] [3] Wherein it differs from lead and cadmium. [4] Absence of sulphates. [5] Absence of lime. Absence of persalts[6] and protosalts[7] of iron. [8] The precipitate is oxide of zinc.

LIQUOR ZINCI CHLORIDI — SOLUTION OF THE CHLORIDE OF ZINC.—*Synonym:* Sir William Burnett's disinfecting fluid.

PREPARATION.—*Take of granulated zinc,* 1 *pound; hydrochloric acid,* 44 *fluid ounces; solution of chlorine, a sufficiency; carbonate of zinc,* ½ *ounce, or a sufficiency; distilled water,* 1 *pint. Mix the hydrochloric acid and water in a porcelain dish, add the zinc, and apply a gentle heat to promote the action until gas is no longer evolved. Boil for half-an-hour, supplying the water lost by evaporation, and allow the product to cool. Filter it into a bottle, and add solution of chlorine by degrees, with frequent agitation, until the fluid acquires a permanent odour of chlorine. Add the carbonate of zinc, in small quantities at a time, and with renewed agitation, until a brown sediment appears. Filter the liquid into a porcelain basin, and evaporate until it is reduced to the bulk of two pints.*

The solution of the chloride of zinc has the advantage over the dry form of being easily kept. Its specific gravity is 1·593. It is considerably weaker than the original "Burnett's Fluid," the specific gravity of which was 2·0. When used as a deodorising agent it is said to decompose sulphuretted hydrogen, thus—$ZnCl_2 + H_2S = ZnS + 2HCl$.

Dose.—Half-a-grain to two or three grains, well diluted (rarely used.)

Antidotes. — Albumen — Magnesia — Chalk — Carbonate of Soda — Emetics.

Chloride of zinc, in the form of Sir William Burnett's disinfecting fluid, is sometimes taken by accident. It acts powerfully and fatally, producing the symptoms of a corrosive irritant poison. Medicinally, the chloride is but seldom given internally, but has been employed as a nervine tonic. It acts as a deeply-penetrating and powerful escharotic, destroying the part and causing great pain, which lasts for several hours. It may be applied in a thin layer in the form of a paste (made with flour, plaster of Paris, or gypsum), which may be left in contact with the part for several hours, a poultice being applied soon after its application. The neighbouring parts must be well protected. It is applied to ulcerated surfaces, not only with the view of removing morbid tissues, but also to bestow a healthy condition upon the parts immediately beneath the eschar; it is used in cancer, lupus, and a variety of callous and indolent ulcers, morbid growths, &c. It has been employed also to destroy nævi, and to arrest the pain of toothache; for which latter purpose, the cavity of the tooth having been cleaned out, a piece of wax, or lint, dipped in a mixture of the chloride and flour or plaster of Paris, is inserted, care being taken to protect the surrounding tissues. It is also used as an injection in gonorrhœa, and as a collyrium in gonorrhœal ophthalmia; in both cases it requires cautious application, of the strength of half-a-grain or a grain to the ounce of water.

Zinci Carbonas {($ZnO, CO_2 + 2ZnO + 3HO$ or $ZnCO_3\ (ZnO)_2\ 3H_2O$)}—Carbonate of Zinc—Zincic Carbonate. The native impure carbonate of zinc is called also Calamine.

PREPARATION.—*Take of sulphate of zinc,* 10 *ounces; carbonate of soda,* $10\frac{1}{2}$ *ounces; boiling distilled water, a sufficiency. Dissolve the carbonate of soda with a pint of the water in a capacious porcelain vessel, and pour into it the sulphate of zinc also dissolved in a pint of the water, stirring diligently. Boil for fifteen minutes after effervescence has ceased;*[1] *and let the precipitate subside. Decant the supernatant liquor, pour on the precipitate three pints of boiling distilled water, agitating briskly; let the precipitate again subside, and repeat the processes of affusion of hot distilled water and subsidence, till the washings are no longer precipitated by chloride of barium.*[2] *Collect the precipitate on calico, let it drain, and dry it with a gentle heat.*

Rationale.—{$3(ZnSO_4 7H_2O + 3(Na_2CO_3 10H_2O) = ZnCO_3(ZnO)_2 3H_2O + 3Na_2SO_4 10H_2O + 18H_2O + 2CO_2$}.

[1] That is, after the escape of the carbonic acid. [2] That is, when all the sulphate of soda is washed away.

CHARACTERS.—*White, tasteless, inodorous, insoluble in water; soluble, with effervescence and without residue, in diluted nitric acid.*[1]

PURITY TESTS.—*This solution is not affected by chloride of barium*[2] *or nitrate of silver,*[3] *and gives with carbonate of ammonia a white precipitate entirely soluble without colour in an excess of the reagent,*[4] *forming a solution which is precipitated white by sulphide of ammonium.*

[1] Characteristic of a salt of zinc. [2] Absence of sulphates. [3] Absence of chlorides. [4] Iron, if present, would be precipitated and not redissolved; the absence of a blue colour indicates its freedom from copper. It occurs as a powder consisting of hydrated carbonate with hydrated oxide of zinc. The calamine, or impure carbonate, formerly used, was a very uncertain preparation, in some instances being entirely represented by sulphate of baryta, coloured with Armenian bole to give it the flesh colour of calamine.

Carbonate of zinc is but little employed, its actions, uses, and doses being the same as the oxide of zinc. Its chief employment is as a dessicant and astringent application to abrasions, ulcerations, and cutaneous diseases.

Zinci Acetas ($ZnOC_4H_3O_3 + 2HO$, or $Zn(C_2H_3O_2)_2QH_2O$—Acetate of Zinc—Zincic Acetate.

PREPARATION.—*Take of carbonate of zinc,* 2 *ounces; acetic acid,* 5 *fluid ounces, or a sufficiency; distilled water,* 6 *fluid ounces. Add the carbonate of zinc in successive portions to three ounces of the acetic acid previously mixed with the water in a flask; heat gently, add by degrees the remainder of the acid till the carbonate is dissolved; boil for a few minutes, filter while hot, and set it aside for two days to crystallise. Decant the mother liquor; evaporate to one-half, and again set it aside for two days to crystallise Place the crystals in a funnel to drain, then spread them on filtering paper on a porous tile, and dry them by exposure to the air at ordinary temperatures.*

Rationale.—Carbonic acid is given off, and the acetic acid joins the zinc,—($ZnCO_3 + 2HC_2H_3O_2 = Zn\ (C_2H_3O_2)_2 + H_2O + CO_2$).

CHARACTERS.—*Thin translucent and colourless crystalline plates, of a pearly lustre, with a sharp unpleasant taste, evolving acetic acid when decomposed by sulphuric acid ;*[1] *soluble in water and the solution precipitated pure white by sulphuretted hydrogen.*[2]

PURITY TESTS.—*A dilute watery solution is not affected by chloride of barium*[3] *or nitrate of silver ;*[4] *and when slightly acidulated with hydrochloric acid, is not precipitated by sulphuretted hydrogen ;*[5] *after it has been boiled for a few minutes with a little nitric acid, it yields with ammonia a white precipitate entirely soluble without colour in an excess of the reagent.*[6]

Characteristic of an acetate[1] and of a salt of zinc.[2] [3] Absence of sulphates. [4] Absence of chlorides. [5] Absence of lead. [6] Iron, if present, would be precipitated and not redissolved ; a blue colour would indicate copper.

Dose.—One to five grains, in pill or solution ; as a lotion or injection, three to ten or twenty grains to an ounce of water ; or as an ointment.

Acetate of zinc acts as an astringent, and as a tonic and antispasmodic. Its chief use is that of a topical astringent ; as a lotion to a variety of skin diseases, as a collyrium in ophthalmia, as an injection in gonorrhœa and leucorrhœa, &c. It is rarely used internally, its actions and uses being similar to those of the sulphate.

Zinci Sulphas ($ZnO,SO_3 + 7HO$, or $ZnSO_4 7H_2O$). *Synonyms:* Sulphate of Zinc—Zincic Sulphate—Sal Vitrioli—Vitriolum Album—White Vitriol—Sulfate de Zinc Schwefelsaures Zinkoxyd.

PREPARATION.—*Take of granulated zinc,* 16 *ounces ; sulphuric acid,* 12 *fluid ounces ; distilled water,* 4 *pints ; solution of chlorine, a sufficiency ; carbonate of zinc,* ½ *ounce, or a sufficiency. Pour the sulphuric acid previously mixed with the water on the zinc contained in a porcelain basin, and, when effervescence has nearly ceased, aid the action by a gentle heat. Filter the fluid into a gallon bottle, and add gradually with constant agitation the solution of chlorine until the fluid acquires a permanent odour of chlorine. Add now with continued agitation the carbonate of zinc until a brown precipitate appears ; let it settle, filter the solution, evaporate till a pellicle forms on the surface, and set aside to crystallise. Dry the crystals by exposure to the air on filtering paper placed on porous tiles. More crystals may be obtained by again evaporating the mother liquor.*

Rationale.—In the first place sulphate of zinc is formed, hydrogen being at the same time evolved, thus—$Zn + H_2SO_4 = Zn\ SO_4 + 2H$—and by the first filtration any insoluble impurities are removed. But the zinc almost invariably contains some iron, which is also converted into soluble sulphate ($FeSO_4$), and is associated with the sulphate of zinc ; in order to get rid of the iron, it is first converted into perchloride, by the addition of the chlorine, and then by the addition of carbonate of zinc, the iron is precipitated in the form of "a brown sediment" of peroxide, which is removed by filtration ; thus—$Fe_2Cl_6 + ZnCO_3\ (ZnO)\ _2 3H_2O =$

$Fe_2O_3 + 3Zn\ Cl_2 + 3H_2O + CO_2$. Lastly, the sulphate of zinc crystallises out, whilst the chloride remains behind in solution.

CHARACTERS.—*In colourless transparent prismatic crystals, with a strong metallic styptic taste. Its solution in water gives white precipitates with chloride of barium*[1] *and sulphide of ammonium.*[2]

PURITY TESTS.—*Its watery solution is not tinged purple by tincture of galls;*[3] *and when acidulated with sulphuric or hydrochloric acid gives no precipitate with sulphuretted hydrogen.*[4] *After it has been boiled for a few minutes with a little nitric acid, it yields with ammonia a white precipitate which is entirely soluble without colour in an excess of the reagent.*[5]

Characteristic of sulphate[1] of zinc.[2] [3] Absence of iron. [4] Absence of lead. [5] The precipitate is oxide of zinc, which is soluble in excess of the reagent, but if iron were present, it would be precipitated, but not re-dissolved; a blue colour would indicate copper. The crystals of sulphate of zinc are slightly efflorescent, are readily soluble in water, at 212° they lose six atoms of water, and the last atom at a dull red heat, when they constitute the white and friable anhydrous sulphate. The distinguishing characters of sulphate of zinc, sulphate of magnesia, and oxalic acid, are given at page 172.

Dose.—As a tonic and astringent, one to five or ten grains, gradually increased, in pill or solution; as an emetic, ten to thirty grains; as a solution or injection, one to thirty grains to an ounce of fluid; as a caustic, the dried sulphate finely levigated, either used alone or made into a paste with glycerine, or as an ointment.

Antidotes.—Facilitate the vomiting by the administration of tepid water or demulcent drinks; albumen; milk; infusions containing tannin, such as of tea, or of oak-bark, &c. Treat the symptoms of irritation as they arise, and according to their severity.

Sulphate of zinc in over-doses acts as a purely irritant poison, causing violent vomiting with severe abdominal pain, followed by extreme prostration, with or without convulsions. Medicinally, it acts as a nervine tonic, astringent, and antispasmodic; as a safe, prompt, and energetic stimulating emetic; and externally, as a topical astringent. It is employed in epilepsy, chorea, hysteria, spermatorrhœa, nervous exhaustion from excesses, spasmodic asthma, angina pectoris, chronic diarrhœa, dysentery, and in other chronic passive discharges, &c. As an emetic, it causes but little subsequent depression, and is useful in narcotic poisoning, &c.; as an injection, it is used in gonorrhœa, leucorrhœa, &c. As an astringent lotion, it is applied to certain varieties of ulcers and chronic skin diseases; as a collyrium, in ophthalmia; as a caustic, it is used in the anhydrous state of dried sulphate of zinc, and is applied to broken diseased surfaces, as it does not operate as such where the epithelium is entire.

Zinci Valerianas ($ZnO,C_{10}H_9O_3$, or $Zn(C_5H_9O_2)_2$.—Valerianate of Zinc—Zincic Valerianate.

PREPARATION.—*Take of sulphate of zinc, $5\frac{3}{4}$ ounces; valerianate of soda, 5 ounces; distilled water, a sufficiency. Dissolve the sulphate of zinc and the valerianate of soda, each in two pints of the water; raise both solutions to near the boiling point, mix them, cool, and skim off the crystals which are produced. Evaporate the mother liquor at a heat not exceeding* 200°, *till it is reduced to four ounces; cool again, remove the crystals which have formed, and add them to those which have been already obtained. Drain the crystals on a paper filter, and wash them with a small quantity of cold distilled water, till the washings give but a very feeble precipitate with chloride of barium. Let them now be again drained, and dried on filtering paper at ordinary temperatures.*

Rationale. — $ZnSO_4 + 2(NaC_5H_9O_2) = Zn(C_5H_9O_2)_2 + Na_2SO_4$. — The crystals which are first produced float upon the surface, and are easily skimmed off; and those which are afterwards obtained, being almost insoluble in cold water, are readily separated from the sulphate of soda. Washing with cold distilled water removes any adherent sulphate of soda.

CHARACTERS.—*In brilliant white pearly tabular crystals, with a feeble odour of valerianic acid, and a metallic taste; scarcely soluble in cold water or in ether; soluble in hot water and alcohol. Heated to redness in an open crucible, it leaves a residue which, when dissolved in diluted sulphuric acid, yields, with ammonia, a precipitate which entirely dissolves in excess of the reagent, and the resulting solution gives a white precipitate with sulphide of ammonium.*

TESTS.—*Its solution in hot water is not precipitated by chloride of barium.*[1] *It gives, when heated with diluted sulphuric acid, a distillate which, when mixed with the solution of acetate of copper, does not immediately affect the transparency of the fluid, but forms after a little time oily drops, which gradually pass into a bluish-white crystalline deposit.*[2]

[1] Characteristic of a salt of zinc. [2] Absence of sulphates. [3] The object of this test is to detect the substitution of *butyrate* for *valerianate* of zinc; the distillate above referred to will therefore be either *valerianic* or *butyric* acid; butyrate of copper is insoluble, whereas valerianate of copper is to a considerable extent soluble, so that, if on the addition of the acetate of copper there be an immediate deposit, butyrate of zinc may be suspected; but if the deposit be delayed, it may be supposed to be valerianate of copper. This salt, like the other somewhat expensive valerianates, may be fraudulently misrepresented by the sulphate or acetate or oxide of zinc flavoured with oil of valerian.

Dose.—Half-a-grain to two or three grains, in pill.

Valerianate of zinc acts as a nervine tonic and antispasmodic; it is employed in those cases in which the other preparations of zinc are used; but it is especially useful in cases complicated with hysteria, and has been highly recommended in the neuralgia of that class. It has also been recommended as an indirect anthelmintic, useful in the convulsive diseases of children.

ZINCI LACTAS—Lactate of Zinc—may be prepared by dissolving metallic zinc or the carbonate in lactic acid. It has been recommended, in doses of two or three grains gradually increased, in epilepsy, &c., as a substitute for the oxide, as being easier of digestion.

ZINCI IODIDUM—Iodide of Zinc—may be prepared by digesting two parts of iodine with one of zinc in four parts of water until the colour of the iodine has disappeared; then filter, evaporate, pour it upon a slab, and break into pieces, which, being deliquescent, must be kept in well-stoppered bottles. It has been recommended in one-grain doses in scrofulous affections, and externally, in the form of solution or ointment, to enlarged glands; it is caustic and poisonous.

ZINCI CYANIDUM—Cyanide or Cyanuret of Zinc, or Hydrocyanate of Protoxide of Zinc—may be prepared by double decomposition between sulphate of zinc and solutions of cyanide of potassium, or by passing the vapour of prussic acid into water containing recently prepared hydrated oxide of zinc in suspension, or into a solution of acetate of zinc. It occurs as a brilliant white, inodorous, tasteless powder, insoluble in water and alcohol, but soluble in hydrochloric acid. When triturated it emits the odour of hydrocyanic acid. It has been recommended as possessed of the combined properties of zinc and hydrocyanic acid, and has been given in epilepsy, chorea, &c., and also as an anthelmintic. Its dose is from a sixth of a grain to a grain, cautiously used. *Ferrocyanide of Zinc,* having properties somewhat like those of the cyanide, has been recommended in similar cases, in doses of one, two, or more grains.

CADMIUM ($Cd = 56$ or 112) is a somewhat rare metal, and is contained in certain of the zinc ores, from which it may be easily separated, in consequence of its being more volatile than zinc. It is a lustrous metal, resembling tin in most of its properties. *Iodide of Cadmium* (*Cadmii Iodidum,* CdI or CdI_2), as well as its ointment, has already been noticed under Iodine (see page 139), since it agrees more in its actions with iodine than with cadmium. *Sulphate of Cadmium* (*Cadmii Sulphas,* $CdO,SO_3 + 4HO$ or $CdSO_4 4H_2O$) may be prepared by dissolving cadmium in equal parts of nitric acid and water, by the aid of heat, precipitating the carbonate of cadmium by carbonate of soda, washing this carefully, and dissolving it in diluted sulphuric acid, and finally evaporating and crystallising. It forms transparent, colourless, prismatic crystals, which effloresce in the air, and are very soluble in water. Sulphate of cadmium has been proposed as a substitute for sulphate of zinc, which it closely resembles in its properties, but is more powerful. In over-doses it is a powerful irritant poison. It is used externally as a lotion, collyrium, or injection, in chronic inflammatory affections of the eye and ear, &c.

NICKEL ($Ni = 29{\cdot}5$, or 59) is chiefly obtained from an arsenical nickel ore. It is a white, ductile, malleable metal, of specific gravity 8·8. *Sulphate of Nickel* ($NiO,SO_3 + 7HO$, or $NiSO_4 7H_2O$) may be obtained by dissolving the oxide or carbonate of nickel in diluted sulphuric acid, evaporating and crystallising. It forms emerald-green prismatic crystals, which have a sweet astringent taste, effloresce in the

air, and are readily soluble in water, but are insoluble in alcohol and ether. It has been recommended as a tonic in doses of half-a-grain to a grain, in pill or solution, and was employed with advantage by Sir James Y. Simpson in obstinate periodic headache.

STANNUM ($Sn = 59$, or $Sn^{iv} = 118$)—Tin—Etain—Zinn—the Jupiter of the alchemists, ♃—is chiefly obtained from the native peroxide, which is widely distributed. Tin is a silvery-white or yellowish-white metal, of a hardness between gold and lead, malleable, but imperfectly ductile. In the form of tin-foil it usually contains a considerable quantity of lead, and may also contain arsenic. Grain tin, procured from stream tin, is the purest form of the metal, and from this is prepared, by fusing it, and pouring it into water, the granulated tin which is placed in the Appendix of the Pharmacopœia. *Pulvis Stanni—Limatura Stanni—Powdered Tin or Tin Filings*—has been used as a vermifuge, its action as such depending probably upon the mechanical irritation of its particles; but it has been suggested that it might arise from the evolution of hydrogen during the solution of the metal in the gastric fluid. *Dose*, twenty to sixty grains, or more, mixed with treacle, several times repeated, preceded and followed by a laxative. *Stanni Chloridum—Chloride of Tin, or Butter of Tin* ($SnCl_2$)—has been employed as a tonic and antispasmodic in epilepsy, chorea, &c., and externally as a lotion in certain chronic cutaneous diseases, &c. *Dose*, a tenth of a grain to half-a-grain. In large doses it acts as an irritant poison, producing violent convulsions. Solution of chloride of tin is used as a test.

BISMUTHUM ($Bi = 210$)—Bismuth—Marcasite—*Bismuth—Wismuth*—in the native state is widely distributed, and is readily extracted from its ores by fusion. It is a reddish-white, tasteless, inodorous metal. It may be obtained in beautiful masses of iridescent cubical crystals. Commercial bismuth may contain several metallic impurities, such as arsenic, iron, copper, &c.

The Pharmacopœia gives the following formula for obtaining pure bismuth:—

Bismuthum Purificatum.—Purified Bismuth.

PREPARATION.—*Take of bismuth,* 10 *ounces; nitrate of potash in powder,* 2 *ounces. Put the bismuth and one ounce of the nitrate of potash into a crucible, and heat them to a temperature at which both the metal and the salt are fused. Continue the heat, constantly stirring the contents of the crucible, for fifteen minutes, or until the salt has solidified into a slag over the metal. Then remove the salt, add the remainder of the nitrate of potash to the bismuth in the crucible, and repeat the process as before. Finally, pour the bismuth while fused into a suitable mould, and allow it to cool.*

The impurities form a slag with the nitre, and are thus separated.

CHARACTERS.—*A crystalline metal of a greyish-white colour, with a distinct roseate tinge. Specific gravity,* 9·83.

TESTS.—*Dissolved in a mixture of equal volumes of nitric acid and distilled water, it forms a solution which by evaporation yields colourless*

crystals,[1] *that are decomposed on the addition of water, giving a white precipitate.*[2] *If the mother liquor from which the crystals have been separated be added to solution of carbonate of ammonia, the precipitate formed and the solution are free, or nearly free, from colour.*

[1] The ternitrate of bismuth, $Bi3NO_35H_2O$. [2] The precipitate consists chiefly of subnitrate of bismuth ($BiNO_4H_2O$), an acid salt remaining in solution. [3] Absence of iron and copper.

Bismuthi Subnitras ($BiO_3NO_5 + 2HO$, or $BiNO_4H_2O$). Subnitrate of Bismuth. *Synonyms:* Bismuthum Album—White Bismuth—Bismuthi Nitras—Nitrate of Bismuth—Trisnitrate of Bismuth—Magistery of Bismuth—Sousnitrate de Bismuth—Wismuth Weiss.

Preparation.—*Take of purified bismuth, in small pieces,* 2 *ounces; nitric acid,* 4 *fluid ounces; distilled water, a sufficiency. Mix the nitric acid with three ounces of distilled water, and add the bismuth in successive portions. When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluid ounces, and pour it into half-a-gallon of distilled water. When the precipitate which forms has subsided, decant the supernatant liquid, add half-a-gallon of distilled water to the precipitate, stir them well together, and after two hours decant off the liquid, collect and drain the precipitate in a calico filter, press it with the hands, and dry it at a temperature not exceeding* 150°.

Rationale.—The bismuth being oxidised by the nitric acid, is converted into ternitrate, whilst the nitric oxide, which is at the same time formed, partly passes off with effervescence; thus—$Bi + 4HNO_3 = Bi3NO_3 + 2H_2O + NO$. In order to drive off any remaining nitric oxide, the solution is heated nearly to ebullition, so that, after decantation, there remains only the ternitrate in solution. When the condensed solution is poured into water, the ternitrate is broken up into two distinct salts—a *supernitrate,* which remains in solution, and a *subnitrate* or *trisnitrate,* which forms an insoluble precipitate, and is the salt desired ($BiNO_4H_2O$). The soluble supernitrate is removed by decantation.

Characters.—*A heavy white powder in minute crystalline scales, blackened by sulphuretted hydrogen;*[1] *insoluble in water, but soluble in nitric acid mixed with half its volume of distilled water, forming a solution which poured into water gives a white precipitate.*[2] *It forms with sulphuric acid, diluted with an equal bulk of water, a solution which is blackened by sulphate of iron.*[3]

[1] Characteristic of a salt of bismuth. [2] Simply a restoration of the white bismuth. [3] By the addition of sulphuric acid, nitric acid is liberated, and is decomposed by the sulphate of iron, which appropriates three equivalents of its oxygen, and, together with the nitric oxide thus liberated, forms a brownish-black compound, which is characteristic of nitric acid, and therefore proves the salt to be a nitrate. There are various opinions as to the constitution of this preparation. It is a heavy, tasteless, inodorous, pearly, crystalline powder, which becomes grayish when exposed to the influence of light for a length of time—a

circumstance due either to the presence of silver as an impurity, or to the formation of a sulphuret of bismuth by exposure to the air.

PURITY TESTS.—*The nitric acid solution gives no precipitate with diluted sulphuric acid*[1] *nor with solution of nitrate of silver.*[2]

[1] Absence of lead. [2] Absence of chlorides.

Trochisci Bismuthi—Bismuth Lozenges.

PREPARATION.—*Take of subnitrate of bismuth,* 1440 *grains; carbonate of magnesia,* 4 *ounces; precipitated carbonate of lime,* 6 *ounces; refined sugar,* 29 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; rose water, a sufficiency. Mix the dry ingredients, then add the mucilage, and form the whole into a proper mass with rose water. Divide the mass into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains two grains of subnitrate of bismuth.*

Dose.—Of the powder, two to ten, twenty, or more grains in powder, or suspended in a draught or mixture by mucilage, or in electuary. Of the lozenges, two to six.

Subnitrate of bismuth, known in commerce as Pearl White or Spanish White, was chiefly employed as a cosmetic, till Odier, of Geneva, pointed out its therapeutical value, in 1786. Since that period it has come into very general use medicinally, both on the Continent and in this country. Poisonous properties have been assigned to it in doses of one hundred and twenty grains and upwards, and some fatal cases, with symptoms of irritant poisoning, have been attributed to it. But there is the best reason to believe that these accidents were due, not to the subnitrate of bismuth, but, either to the existence of arsenic in it as an impurity (a frequent occurrence, if great care is not taken to have the bismuth from which the subnitrate is prepared thoroughly purified), or to the administration of the ternitrate instead of the subnitrate. The latter accident is the more likely to happen, that the term nitrate has been applied both to the subnitrate and the ternitrate. Doses of the subnitrate, ranging from half-an-ounce to two ounces per diem, have been frequently administered, and not the slightest inconvenience has resulted. The ternitrate, on the other hand, is caustic and irritant.

Internally, the subnitrate is used as a sedative and astringent. It is employed to allay irritability of the stomach, and to check vomiting and diarrhœa. For this purpose it is useful in painful dyspepsia with a tendency to diarrhœa; to allay the irritability resulting from the action of certain poisons in subacute and chronic gastritis, in the chronic gastritis of drunkards, in gastric ulcer, non-

malignant and malignant (in the latter as a palliative), &c. When the vomited matters or the gaseous eructations are acid, it is well to combine bismuth with magnesia or an alkaline carbonate. Its action is also frequently aided by small doses of opium. If in dyspepsia the tongue is foul, and the breath smells of rotten eggs, better precede its use by a saline purgative. Bismuth is seldom beneficial in dyspepsia associated with constipation. As an astringent, it is useful during the latter stages of, and period of convalescence from, typhoid fever, in which case it may beneficially be combined with opium; in mucous diarrhœa, in the premonitory diarrhœa of cholera, in the diarrhœa of phthisis, in chronic dysentery, in diarrhœa following upon weaning, or persisting, after the cutting of a tooth. Externally, it is employed as an astringent, desiccant, and sedative, dusted over surfaces in powder, or applied in lotion or ointment.

As an injection, it is employed in leucorrhœa, gonorrhœa, gleet, &c.; as dusting-powder, ointment, or lotion, it is used in chapped nipples, hands, fissures, abrasions, chronic cutaneous disorders, in which cases it is found to absorb moisture, allay smarting and itching, while it protects the parts affected from the air. In irritability of the vagina or cervix it is well applied as pessary (15 grains in each), with or without atropine or other sedative.

It is exceedingly doubtful whether it exerts any remote sedative effect through the nervous system, or whether it acts merely locally. It most probably exerts a topical action only. It ought to be remembered that during the administration of bismuth the stools become black. To be useful in cases of gastric irritation, it is often necessary to give doses of from ten to twenty grains, three times a-day.

Bismuthi Carbonas — Carbonate of Bismuth $\{2(BiO_3CO_2)HO$, or $\mathbf{2(Bi_2CO_5)H_2O}\}$. *Synonym:* Subcarbonate of Bismuth.

PREPARATION.—*Take of purified bismuth in small pieces,* 2 *ounces; nitric acid,* 4 *fluid ounces; carbonate of ammonia,* 6 *ounces distilled water, a sufficiency. Mix the nitric acid with* 3 *ounces of distilled water, and add the bismuth in successive portions. When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and afterwards decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluid ounces, and add this in small quantities at a time to a cold filtered solution of the carbonate of ammonia in two pints of distilled water, constantly stirring the mixture as it is formed. Collect the precipitate on a calico filter, and wash it with distilled water until the washings pass tasteless. Remove now as much of the adhering water as can be separated from the precipitate by slight pressure with*

the hands, and finally dry the product at a temperature not exceeding 150°.

Rationale.—The bismuth dissolved in nitric acid forms ternitrate of bismuth ($Bi3NO_3$) with evolution of nitric oxide, which causes the effervescence, as explained under the subnitrate. The solution is afterwards heated, to make sure that the nitric oxide is completely expelled. The ternitrate is then decomposed by the carbonate of ammonia forming carbonate of bismuth, $2(Bi_2CO_5)H_2O$, and nitrate of ammonia (NH_4NO_3). The nitrate of ammonia remains in solution, while the carbonate of bismuth, being insoluble, falls down as a precipitate.

CHARACTERS AND TESTS.—*A white powder blackened by sulphuretted hydrogen ;*[1] *insoluble in water, but soluble with effervescence in nitric acid.*[2] *When added to sulphuric acid, coloured with sulphate of indigo, the colour of the latter is not discharged.*[3] *If to nitric acid, mixed with half its volume of distilled water, as much carbonate of bismuth be added as the acid will dissolve, one volume of this solution poured into twenty volumes of water will yield a white precipitate.*[4] *The nitric acid solution gives no precipitate with diluted sulphuric acid,*[5] *or with solution of nitrate of silver.*[6]

[1] Character of a salt of bismuth. [2] Indication of the presence of carbonic acid. [3] Does not contain nitrate. [4] Character of salts of bismuth, the precipitated salt is the subnitrate. [5] Absence of lead. [6] Absence of chlorides.

Dose.—Five to twenty grains.

The carbonate agrees in action with the subnitrate ; but from its greater solubility in the gastric juice, it is found to agree when the subnitrate occasions a sensation of weight, and even prickling, in the stomach. For this reason, and also because it is slightly antacid, it is often to be preferred in cases in which the tongue is red and pointed, or when digestion is painful, and accompanied by belching of acid matters, smelling of sulphuretted hydrogen.

Liquor Bismuthi et Ammoniæ Citratis—Solution of Citrate of Bismuth and Ammonia. *Synonym:* Liquor Bismuthi.

PREPARATION.—*Take of purified bismuth,* 430 *grains : nitric acid,* 2 *fluid ounces ; citric acid,* 2 *ounces ; solution of ammonia and distilled water, of each a sufficiency. Mix the nitric acid with an ounce of distilled water, and add the bismuth in successive portions. When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluid ounces. Then add the citric acid previously dissolved in four ounces of distilled water, and afterwards the solution of ammonia in small quantities at a time, until the precipitate formed is redissolved, and the solution is neutral or slightly alkaline to test-paper. Dilute with distilled water to the volume of one pint.*

Rationale.—Ternitrate of bismuth is formed by the action of nitric acid on the bismuth. To the solution citric acid and ammonia are

added, which have the property of forming a soluble compound of bismuth, the presence of citric acid and ammonia in solution rendering many of the metallic oxides soluble when they otherwise would not be so.

CHARACTERS.—*A colourless solution, with a saline and slightly metallic taste. Specific gravity,* 1·122. *Neutral or slightly alkaline to test-paper; mixes with water without change; heated with solution of potash it evolves ammonia, and yields a white precipitate.*[1] *Hydrochloric acid added to it gives a white precipitate, which is soluble in excess of the reagent.*[2] *Three fluid drachms of the solution, mixed with an ounce of distilled water, and treated with sulphuretted hydrogen in excess, yield a black precipitate,*[3] *which, collected, washed, and dried, weighs* 9·92 *grains. One fluid drachm contains* 3 *grains of oxide of bismuth.*

[1] Hydrated peroxide of bismuth. [2] The precipitate is peroxide of bismuth, which is thrown down when the ammonia is neutralised, but redissolved in excess of hydrochloric acid. [3] Common to all salts of bismuth.

The desideratum of a preparation of bismuth miscible in water, vegetable infusions, &c., in all proportions, was supplied to the profession a few years ago by Mr Schacht of Clifton. This preparation he styled Liquor Bismuthi; but it is more properly a solution of the citrate of ammonia and bismuth, which is the name adopted for the officinal preparation. The process in the Pharmacopœia seems, however, essentially defective, as there is no means of getting rid of the nitric acid. Prepared according to this process, there is found, on testing, a considerable quantity of nitric acid, whereas Schacht's preparation gives indication of only a trace. Schacht's solution is formed by first dissolving bismuth in nitric acid, then throwing down the teroxide of bismuth with ammonia; filtering, washing the filter to get rid of the nitric acid, and afterwards dissolving it in boiling citrate of ammonia. Mr Howie, of the Messrs Smith, Duke Street, Edinburgh, "Pharmaceutical Journal," October, 1866, recommends a new process of forming the liquor from the precipitate of the oxide obtained in presence of a certain proportion of citrate of ammonia. By this means, he states, he succeeds in obtaining a perfectly soluble oxide to convert, by boiling with citrate of ammonia, into liquor bismuthi, the process by precipitating with ammonia alone being found to occasionally give a certain proportion of an insoluble crystalline oxide.

Uses.—This preparation is applicable to all the purposes for which bismuth is administered internally. It is soluble in all proportions in water and proof spirit, and may be given in union with hydrocyanic acid, solutions of morphia and potash, and with tinctures of

hyoscyamus, belladonna, stramonium, &c., as well as with tonic vegetable infusions. It is therefore exceedingly useful when we wish to combine the sedative action of the bismuth with another sedative or anodyne medicine in the same solution.

Dose.—One-half to one fluid drachm.

PLUMBUM (Pb=103·5 or 207)—Lead—the Saturn of the alchemists, ♄—Plomb—Blei—occurs in a variety of native compounds, but its chief source, for commercial purposes, is the sulphide commonly called *galena.* Pure lead is a bluish-white, brilliant, soft and flexible metal; it soon tarnishes when exposed to the air, emits a peculiar odour when handled, leaves a dark streak upon paper, and has a specific gravity of 11·4.

In the metallic form lead is inert in the system, but its soluble salts are astringent and sedative, and have, moreover, an action peculiarly their own. The vapour of lead inhaled produces the same effects as the soluble salts when taken by the stomach; but in all cases the metal must assume a soluble condition either before its administration, or in the gastric fluid, before it can influence the system through the circulation. The carbonate is probably the most poisonous, and by Dr A. T. Thompson was considered to be the only poisonous, salt of lead; but all the salts of lead, if we except the sulphide, and perhaps the sulphate, are more or less poisonous. In large doses the soluble salts of lead act as irritants, and produce the ordinary symptoms, but acute lead poisoning is comparatively rare; in such cases the vomiting is not generally very violent, but the colicky pains are very severe, and there is obstinate constipation. On the other hand, chronic poisoning by lead is a common occurrence. It arises from the gradual accumulation of the poison in the system, either by drinking water in which it is dissolved; or by its absorption through the skin, though this can be but to a limited extent; or by its entrance through wounds and abrasions; or in consequence of the dirty habits of those who work amongst it, whereby it is conveyed by the unwashed hands to the food, and therewith transmitted to the stomach; or, lastly, by the prolonged medicinal use of one of its salts. *Lead*, or *saturnine colic*, or *colica pictonum*, or *painters' colic*, as it is variously called, is the most common manifestation of lead poisoning. In these cases there is an uneasiness, a sense of sinking, and a twisting pain in the neighbourhood of the umbilicus; the abdominal parietes are retracted, rigid, and knotty, and relief is obtained by pressing the abdomen; there is obstinate constipation, loss of appetite, increasing thirst, dryness of the mouth and throat, a sweetish astringent taste, the patient stating that the bitterest substances taste sweet to him, fetid breath, dry and yellowish or dusky skin and conjunctiva, sallow and shrunken countenance, general emaciation, great depression of spirits, and a characteristic blue line along the margins of the gums, which is interrupted wherever a tooth is lost. This blue line is supposed to be due to the formation of sulphide of lead, produced in that situation by the decomposition of particles of food collected between the teeth. It was first observed by Dr Burton. If the poisoning be continued, paralysis usually follows, though in rare instances it precedes, the

colicky symptoms. There may be loss of sensation as well as of voluntary motion, and either or both may be accompanied by flitting neuralgic pains in different parts of the body, which are usually attributed by the patient to rheumatism. These, like the abdominal pains, are usually relieved by pressure, but are aggravated by motion. The most common form of lead palsy is the *dropped-hand* or *wrist-drop*, due to the implication of the extensor muscles of the fore-arm, which, together with the muscles constituting the ball of the thumb, gradually waste away. If the cause be not removed after these symptoms have spread themselves more or less over the trunk and extremities, the brain becomes implicated, being at first sluggish and dull to external impressions, but ultimately taking on abnormal action in the form of delirium, convulsions, or coma, followed by death. There are several names applied to the symptoms of lead poisoning. Thus, in addition to those already mentioned, the term *lead arthralgy* or *metallic rheumatism* is applied to the flitting pains; when there is loss of sensation, it is called *lead* or *saturnine anæsthesia;* and lastly, the affections of the brain are classed under the term *lead* or *saturnine encephalopathy.*

Antidotes.—When the poisoning results from a single over-dose, the indications are to evacuate the stomach by means of an emetic, or by the stomach pump, and this may be preceded by, and certainly should immediately be followed by, a solution of some harmless sulphate, as of magnesia or of soda, with the view of forming the almost inert sulphate of lead: this should be followed by a saline cathartic, such as sulphate of magnesia or sulphate of soda, with subsequent antiphlogistic treatment as may be required. Chronic poisoning is to be combated first by attending to the immediate wants of the patient, and secondly, by eliminating the poison, which can only be effected slowly. Dilute sulphuric acid or sulphate of magnesia may be given to check the action of any of the poison which may still linger in the alimentary canal, whilst factitious sulphur baths may be used to convert that which is near the surface of the body into inert sulphide of lead, whereby the skin is temporarily blackened: in the intervals of the baths the skin should be well rubbed. Iodide of potassium may be given with the view of promoting the discharge of the poison by rendering it more soluble. To prevent lead poisoning, it is necessary to observe cleanliness in the use of leaden or pewter vessels in which food is kept, to avoid the use of water containing the poison, to wash carefully before meals when employed amongst substances containing lead, and also in such cases to take occasional doses of dilute sulphuric acid, or of Epsom salts, if necessary, &c.

Plumbi Oxidum (PbO). *Synonyms:* Lythargyrum — Litharge— Oxide of Lead—Plumbi Oxidum Semivitreum.

Protoxide of lead is formed when the temperature of melted lead is raised to a white heat; it then burns with a brilliant flame, and produces fumes of protoxide, which on cooling constitute *Flowers of Lead.* When the grey powder formed on the surface of melted lead is exposed to the continued action of heat and air, the *massicot* of commerce is produced, and this, when fused and again solidified by cooling, forms the crystalline mass called litharge.

CHARACTERS.—*In heavy scales of a pale brick-red colour, completely soluble without effervescence*[1] *in diluted nitric and acetic acids, either solution, when neutral, giving a copious yellow precipitate with iodide of potassium.*[2]

PURITY TEST.—*Its solution in diluted nitric acid when supersaturated with ammonia and then cleared by filtration, does not exhibit a blue colour.*[3]

[1] Absence of carbonate. [2] Characteristic of lead, the oxide being converted either into the soluble nitrate or acetate, from which it is precipitated as an iodide by the iodide of potassium. [3] Absence of copper.

EMPLASTRUM PLUMBI—LEAD PLASTER.—*Synonyms:* Emplastrum Lithargyri—Diachylon Plaster.—*Take of oxide of lead, in fine powder, 4 pounds; olive oil, 1 gallon; water, 3½ pints. Boil all the ingredients together gently by the heat of a steam bath, and keep them simmering for four or five hours, stirring constantly until the product acquires a proper consistence for a plaster, and adding more water during the process if necessary.*

Oxide of lead is rarely employed except in the preparation of the plaster; it has been used as a dessicant and astringent, dusted over abrasions, ulcers, burns, &c., but it is a somewhat dangerous application. It is never used internally. Lead plaster is employed as the basis of all true plasters. In its preparation the oleic, stearic, and margaric acids of the oil combine with the oxide of lead to form oleate, stearate, and margarate of lead, glycerine, which is at the same time set free, being dissolved out by the water. Lead plaster is used as a support to weak parts and as a common strapping. *Plumbi Oxidum Rubrum* (Pb_3O_4)—Red Oxide of Lead—Red Lead—Minium; and also *Plumbi Oxidum Hydratum*—Hydrated Oxide of Lead, may be employed in the preparation of plasters, and have been used for a variety of pharmaceutical purposes, but they are rarely resorted to now.

Plumbi Carbonas $\{2(PbO,CO_2)+HO,PbO$, or $2(PbCO_3)PbO,H_2O\}$. *Synonyms:* Carbonate of Lead—Subcarbonate of Lead—White Lead—Ceussa—Ceruse.

Carbonate of lead is prepared in a variety of ways; chiefly by exposing sheet lead, or bars of lead, to the fumes of acetic or pyroligneous acid, whereby an acetate of lead is formed, which is immediately decomposed by carbonic acid, derived from a mixture of dung and tan in which the vessels containing the acid are placed, and is thus converted into carbonate.

CHARACTERS.—A *soft heavy white powder, blackened by sulphuretted hydrogen,*[1] *insoluble in water, soluble with effervescence in diluted acetic acid*[2] *without leaving any residue,*[3] *and forming a solution which is precipitated white by sulphuric acid,*[4] *and yellow by iodide of potassium.*[5]

PURITY TESTS.—*The acetic solution when treated with excess of sulphu-*

retted hydrogen, boiled and filtered, gives no precipitate with oxalate of ammonia.[6]

[1] Producing sulphide of lead. [2] Characteristic of a carbonate. [3] Absence of impurities insoluble in acetic acid, such as sulphates of lead and baryta. [4] Forming sulphate of lead. [5] Forming iodide of lead. [6] If, when all the sulphide of lead is separated by filtration, the clear liquid gives a precipitate with oxalate of ammonia, lime is present.

UNGUENTUM PLUMBI CARBONATIS—OINTMENT OF CARBONATE OF LEAD.—*Take of carbonate of lead, in fine powder,* 62 *grains; simple ointment,* 1 *ounce. Mix thoroughly.*

Carbonate of lead is never used internally; but is sometimes employed as a dessicant and astringent, and, combined with starch, may be dusted over sores, ulcers, chronic eczema, &c.; but it is apt to be absorbed and produce dangerous results. The ointment is used as a sedative and astringent application to ulcerations, excoriations, painful hæmorrhoids, &c.

Plumbi Acetas ($PbO,C_4H_3O_3 + 3HO$, or $Pb(C_2H_3O_2)_2 3H_2O$). *Synonyms:* Acetate of Lead—Sugar of Lead—Acetate Acide de Plomb—Bleizucker.

PREPARATION.—*Take of oxide of lead, in fine powder,* 24 *ounces; acetic acid,* 2 *pints, or a sufficiency; distilled water,* 1 *pint. Mix the acetic acid and the water, add the oxide of lead, and dissolve with the aid of a gentle heat. Filter, evaporate till a pellicle forms, and set aside to crystallise, first adding a little acetic acid should the fluid not have a distinctly acid reaction. Drain and dry the crystals on filtering paper, without heat.*

Rationale.—The lead of the litharge takes the place of the basic hydrogen in the acetic acid, while its oxygen combines with the liberated hydrogen to form water thus—($PbO + 2(H,C_2H_3O_2) = Pb(C_2H_3O_2)_2 + H_2O$).

CHARACTERS.—*In white crystalline masses, slightly efflorescent, having an acetous odour, and a sweet astringent taste. Its solution in water slightly reddens litmus,*[1] *gives a yellow precipitate with iodide of potassium,*[2] *and is precipitated white by sulphuric acid,*[3] *acetic acid being set free.*

PURITY TESTS.—*Its solution in distilled water is clear, or has only a slight milkiness, which disappears on the addition of acetic acid.*[4] *Thirty-eight grains dissolved in water require for complete precipitation* 200 *grain-measures of the volumetric solution of oxalic acid.*

[1] It has a slightly acid reaction. [2] Producing iodide of lead, characteristic of a lead salt. [3] Producing sulphate of lead, the free acetic acid proving it to be an acetate. [4] Indicating a trace of carbonate which is decomposed by the acetic acid, the carbonic acid being liberated.

PILULA PLUMBI CUM OPIO—PILL OF LEAD AND OPIUM.—*Take of acetate of lead, in fine powder,* 36 *grains; opium, in fine powder,* 6 *grains; confection of roses,* 6 *grains. Beat them into a uniform mass.*

Dose.—Of the acetate, two or three grains, repeated every two or three hours; or in larger doses, up to eight or ten grains, thrice a-day; it may be given in pill with confection of roses; if given in mixture a little acetic acid must be added to keep it in solution, otherwise the carbonic acid present in water would precipitate it. As a lotion or collyrium, from two to ten or twenty or more grains, dissolved in water with a little acetic acid to facilitate the solution. It should not be used as a collyrium when there is ulceration of the cornea, as it is apt to cause a permanent opacity. Of the *Pilula Plumbi cum Opio*, one four-grain pill (containing three grains of the acetate, half-a-grain of opium, and half-a-grain of confection of roses) may be repeated every two or three hours.

SUPPOSITORIA PLUMBI COMPOSITA—Compound Suppositories of Lead.

Preparation.—*Take of acetate of lead,* 36 *grains; opium in powder,* 12 *grains; benzoated lard,* 42 *grains; white wax,* 10 *grains; oil of theobroma,* 80 *grains. Melt the wax and oil of theobroma with a gentle heat, then add the other ingredients previously rubbed together in a mortar, and having mixed them thoroughly, pour the mixture while it is fluid into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository.*

An astringent, antispasmodic, sedative anodyne, and narcotic application, useful in piles, in inflamed and irritable states of the rectum generally, in diarrhœa and dysentery, especially when the latter are accompanied with much tenesmus. One to be used at intervals, depending on the effects required to be produced. Each suppository contains 1 grain of opium and 3 grains of the acetate of lead.

UNGUENTUM PLUMBI ACETATIS—Ointment of Acetate of Lead.—*Take of acetate of lead, in fine powder,* 12 *grains; benzoated lard,* 1 *ounce; mix thoroughly.*

Acetate of lead in over-doses may act as an irritant poison, the treatment for which has already been mentioned in the previous general remarks upon the soluble salts of lead. Medicinally, it acts as an astringent and sedative; it is useful in choleraic diarrhœa, and in chronic diarrhœa and dysentery; in both active and passive hæmorrhages from the lungs, stomach, bowels, urinary organs, and uterus; in menorrhagia; in chronic bronchitis with profuse secretion of mucus; in aneurism of the aorta, and in palpitations with hypertrophy of the heart; in excessive salivation produced by mercury; in ulceration of the stomach, &c. Externally, as a lotion or ointment in a variety of inflammatory skin diseases, superficial inflammations, erysipelas, sprains, abrasions, &c.; as a collyrium, in

ophthalmia, and in the state of impalpable powder it is applied in granular ophthalmia; as an injection, in gonorrhœa, gleet, leucorrhœa, &c.

Liquor Plumbi Subacetatis. *Synonyms:* Solution of Subacetate of Lead—Liquor Plumbi Diacetatis—Aqua Lithargyri Acetatis—Goulard's Extract—Subacetate of Lead ($2PbO,C_4H_3O_3$, or $Pb_2C_4H_6O_5$) dissolved in water.

PREPARATION.—*Take of acetate of lead,* 5 *ounces; oxide of lead, in powder,* $3\frac{1}{2}$ *ounces; distilled water,* 1 *pint, or a sufficiency. Boil the acetate of lead and the oxide of lead in the water for half-an-hour, constantly stirring; then filter, and when the liquid is cold, add to it more distilled water, until the product measures twenty fluid ounces. Keep the clear solution in stoppered bottles.*

Rationale.—$Pb(C_2H_3O_2)_2 + PbO = Pb_2C_4H_6O_5$, dissolved in water.

CHARACTERS.—*A dense clear colourless liquid, with alkaline reaction and sweet astringent taste, becoming turbid by exposure to the air;*[1] *and forming with mucilage of gum arabic an opaque white jelly. Sulphuric acid in excess gives a white precipitate, acetic acid being set free.*[2]

PURITY TESTS.—*Specific gravity,* 1·26. 413·3 *grains by weight* (6 *fluid drachms) require for perfect precipitation* 810 *grain-measures of the volumetric solution of oxalic acid.*

[1] From the absorption of carbonic acid, insoluble carbonate being formed. [2] Sulphate of lead being formed.

LIQUOR PLUMBI SUBACETATIS DILUTUS—DILUTE SOLUTION OF SUBACETATE OF LEAD—GOULARD WATER.—*Take of solution of subacetate of lead, rectified spirit, of each* 2 *fluid drachms; distilled water,* $19\frac{1}{2}$ *fluid ounces. Mix, and filter through paper. Keep the clear solution in a stoppered bottle.*

UNGUENTUM PLUMBI SUBACETATIS COMPOSITUM—COMPOUND OINTMENT OF SUBACETATE OF LEAD—GOULARD'S CERATE.—*Take of solution of subacetate of lead,* 6 *fluid ounces; camphor,* 60 *grains; white wax,* 8 *ounces; oil of almonds,* 1 *pint. Melt the wax with sixteen ounces of the oil by the heat of a water bath, remove the vessel, and, as soon as the mixture begins to thicken, gradually add the solution of subacetate of lead, and stir the mixture constantly while it cools; then add the camphor dissolved in the rest of the oil, and mix thoroughly.*

Solution of subacetate of lead is not used internally; in large doses it is poisonous. Externally, the dilute solution and ointment are useful as a mild astringent and sedative application to many irritable and itching skin diseases, superficial inflammations, erysipelas, bruises, sprains, abrasions, burns, chilblains, &c.; as a collyrium, except when there is ulceration of the cornea; as an injection in leucorrhœa, &c.; as a wash and gargle in mercurial salivation and syphilitic sore throat &c.

PLUMBI NITRAS—NITRATE OF LEAD—(PbO,NO_5 or $Pb(NO_3)_2$.)—May be prepared by saturating dilute nitric acid with litharge with the aid of a gentle heat, filtering and crystallising.

CHARACTERS.—*In colourless octahedral crystals, which are nearly opaque, permanent in the air, of a sweetish astringent taste, soluble in water and in alcohol.*

TESTS.—*The aqueous solution is precipitated black by sulphuretted hydrogen,*[1] *white by diluted sulphuric acid,*[2] *and yellow by iodide of potassium.*[3] *Added to sulphate of indigo it discharges the colour.*

[1] Sulphide of lead. [2] Sulphate of lead, characteristic of lead salt. [3] Iodide of lead.

The nitrate is rarely used internally, and acts like the acetate, in doses of half-a-grain to a grain. In solution, it has been used as an application to chapped nipples, &c. As a deodoriser and so-called disinfectant, it is used because it decomposes sulphuretted hydrogen. *Ledoyen's Disinfecting Fluid* is a solution of this salt, in the proportion of a drachm to an ounce. *Fused Nitrate of Lead* may be used as a caustic. It is used in the preparation of iodide of lead.

PLUMBI CHLORIDUM ($PbCl$, or $PbCl_2$)—Chloride of Lead—obtained either by digesting oxide of lead with heat in hydrochloric acid, or by acting upon a concentrated solution of nitrate of lead with hydrochloric acid, or a solution of chloride of sodium, occurs in small, anhydrous, flat, acicular crystals. It has been proposed as a substitute for chloride of zinc.

PLUMBI IODIDUM—And its plaster and ointment, which are now officinal, are given under Iodine, at pages 138 and 139.

PLUMBI TANNAS—Tannate of Lead—prepared by acting upon a solution of acetate of lead with tannic acid or infusion of galls, has been recommended as an astringent application in the form of ointment, or as a poultice, called in the Prussian Pharmacopœia *Cataplasma ad Decubitum.*

PLUMBI SACCHARAS—Saccharate of Lead—has been proposed as a solvent for phosphatic calculi, by injection into the bladder.

STIBIUM ($Sb = 122$)—Antimonium—Antimony—Antimoine—Antimon—is chiefly obtained from the native sulphide, the Stibium of the ancients. It is a brilliant, bluish-white, crystalline, brittle metal, having a specific gravity of 6·7. The metal itself is not used medicinally, the officinal preparations being obtained from the sulphuret.

Antimonium Nigrum — BLACK ANTIMONY. *Synonyms :* Antimonii Sulphuretum Præparatum — Prepared Sulphuret of Antimony—Antimonii Tersulphuretum—Crude Antimony. Native sulphide of antimony, SbS_3 or Sb_2S_3, purified from siliceous matter by fusion, and afterwards reduced to fine powder. It is placed in the Pharmacopœia as the source of antimonial preparations. It may contain other sulphides, as of arsenic, lead, copper, or iron.

CHARACTERS AND TESTS.—*A greyish-black crystalline powder. It dissolves almost entirely in boiling hydrochloric acid, evolving sulphuretted hydrogen.*

Antimonium Sulphuratum. *Synonyms:* Sulphurated Antimony—Antimonii Oxysulphuretum—Antimonii Sulphuretum Aureum—Golden Sulphuret of Antimony—Antimonii Sulphuretum Præcipitatum—Precipitated Sulphuret of Antimony—Soufre doré d'Antimoine—Gold-Schwefel—Tersulphuret of Antimony, SbS_3, or Sb_2S_3, with a small and variable amount of oxide of Antimony, SbO_3, or Sb_2O_3.

PREPARATION.—*Take of black antimony,* 10 *ounces; solution of soda,* $4\frac{1}{2}$ *pints; diluted sulphuric acid, a sufficiency, distilled water, a sufficiency. Mix the sulphuret of antimony with the solution of soda, and boil for two hours with frequent stirring, adding distilled water occasionally to maintain the same volume. Strain the liquor through calico, and, before it cools, add to it by degrees the diluted sulphuric acid till the latter is in slight excess. Collect the precipitate on a calico filter, wash with distilled water till the washings no longer precipitate with chloride of barium, and dry at a temperature not exceeding* 212°.

In the first place, one equivalent of sulphuret of antimony and three equivalents of caustic soda interchange, producing three of sulphuret of sodium and one of teroxide of antimony: $Sb_2S_3 + 3Na_2O = 3Na_2S + Sb_2O_3$. The sulphuret of sodium unites with and dissolves an atom of tersulphuret of antimony, forming the double soluble salt, Na_3SbS_3, thus: $3Na_2S + Sb_2S_3 = 2(Na_3SbS_3)$, whilst the equivalent of teroxide of antimony is dissolved by union with an atom of caustic soda, forming the double soluble salt, $NaSbO_2$, thus: $Na_2O + Sb_2O_3 = 2(NaSbO_2)$. There are, therefore, in the filtrate two double soluble salts, namely, Na_3SbS_3, and $NaSbO_2$; and if at this stage the liquor were allowed to cool, there would be deposited a compound of $Sb_2S_3 + Sb_2O_3$, the old Kermes Mineral. But by the addition of the sulphuric acid, further changes take place, namely—first, between the acid and the $NaSbO_2$, whereby sulphate of soda is formed in solution, and teroxide of antimony is precipitated: $2NaSbO_2 + H_2SO_4 = Na_2SO_4 + H_2O + Sb_2O_3$; and, secondly, between the acid and the Na_3SbS_3, whereby sulphate of soda is formed in solution, tersulphuret of antimony is precipitated, and sulphuretted hydrogen is formed, part of which escapes: $2(Na_3SbS_3) + 3H_2SO_4 = 3Na_2SO_4 + 3H_2S + Sb_2S_3$. The sulphuretted hydrogen thus formed acts upon the teroxide of antimony, converting it into tersulphuret, $3H_2S + Sb_2O_3 = 3H_2O + Sb_2S_3$, but all the teroxide of antimony is not so changed, because a part of the sulphuretted hydrogen escapes during the process, and therefore the amount of the teroxide in the preparation will be equal to the loss of sulphuretted hydrogen, which is variable.

CHARACTERS.—*An orange-red powder, readily dissolved by caustic soda, also by hydrochloric acid with the evolution of sulphuretted hydrogen and the separation of a little sulphur. Boiled in water with acid tartrate of potash, the resulting solution is precipitated orange-red with sulphuretted hydrogen.*[1]

PURITY TESTS.—*Sixty grains of this preparation, dissolved in hydro-*

chloric acid and dropped into water, give a white precipitate, which, when washed and dried, weighs about 53 *grains.*[2]

[1] There results tartarated antimony, which gives, with sulphuretted hydrogen, a red precipitate of the tersulphide, Sb_2S_3. [2] The precipitate given when the acid solution is dropped into water consists chiefly of teroxide of antimony. The constitution of sulphurated antimony varies, and is differently stated. It is inodorous, has but little taste, is insoluble in water, decomposes to a certain extent when exposed to light and air, sulphur being liberated, and when strongly heated in air, burns with a bluish flame, sulphurous acid being evolved, and oxide of antimony left behind.

Dose.—One to four or five grains, but it is seldom prescribed otherwise than in the compound calomel or Plummer's pill. In larger doses, up to ten or twenty grains, it is emetic.

Sulphurated antimony is said to act as an alterative, diaphoretic, and emetic, but it is so uncertain in its operation that it is rarely employed alone. In the form of Plummer's pill it is used with advantage as an alterative in cutaneous diseases, especially those of syphilitic origin, in chronic rheumatism, &c.

Antimonii Chloridi Liquor—Solution of Chloride of Antimony—Chloride of Antimony, $SbCl_3$, dissolved in hydrochloric acid.

PREPARATION.—*Take of black antimony,* 1 *pound; hydrochloric acid,* 4 *pints. Place the black antimony in a porcelain vessel; pour upon it the hydrochloric acid, and, constantly stirring, apply to the mixture, beneath a flue with a good draught, a gentle heat, which must be gradually augmented as the evolution of gas begins to slacken, until the liquid boils. Maintain it at this temperature for fifteen minutes; then remove the vessel from the fire, and filter the liquid through calico into another vessel, returning what passes through first, that a perfectly clear solution may be obtained. Boil this down to the bulk of two pints, and preserve it in a stoppered bottle.*

Rationale.—$Sb_2S_3 + 6HCl = 3H_2S + 2SbCl_3$. The object of the flue with a good draught is to carry off the poisonous sulphuretted hydrogen as it is evolved.

CHARACTERS.—*A heavy liquid usually of a yellowish-red colour. A little of it dropped into water gives a white precipitate,*[1] *and the filtered solution lets fall a copious deposit on the addition of nitrate of silver.*[2] *If the white precipitate formed by water be treated with sulphuretted hydrogen it becomes orange-coloured.*[3]

PURITY TESTS.—*Specific gravity* 1·47. *One fluid drachm of it mixed with a solution of a quarter of an ounce of tartaric acid in four fluid ounces of water, forms a clear solution, which, if treated with sulphuretted hydrogen, gives an orange precipitate, weighing, when washed and dried at* 212°, *at least* 22 *grains.*[4]

[1] The precipitate consists of a variable mixture of oxide and chloride of antimony, constituting the *oxychloride, Algarotti's powder,* or *mer-*

curius vitæ, formerly used in medicine. [2] Chloride of silver, produced by the hydrochloric acid, which is formed when the chloride is thrown into water, $2SbCl_3 + 3H_2O = Sb_2O_3 + 6HCl$; and again, $HCl + AgNO_3 = AgCl + HNO_3$. [3] Being converted into hydrated tersulphuret of antimony. [4] The precipitate consists of hydrated tersulphuret of antimony. Chloride of antimony may be obtained as a soft, deliquescent, volatile, and readily fusible solid, the old *butter of antimony;* but it is generally kept in solution with an excess of hydrochloric acid, in which is also dissolved a persalt of iron, forming the perchloride, derived from the iron vessels in which the solution is prepared.

Terchloride of antimony was formerly employed in the solid form of *butter of antimony*, but now it is rarely used otherwise than in solution. It acts as a powerful caustic, and as such is applied to the bites of rabid animals, poisoned wounds, cancerous, phagedenic, and sloughing ulcerations, &c., and with a camel's-hair brush it is painted over the projecting surface in staphyloma, its action being stopped in sufficient time by bathing the part with milk and water. It is also found useful in cases of persistent acne of the face, frequently associated with interim derangement. Its action in this case is easily limited by brushing the part with carbonate of soda immediately after the application of the chloride. It is sometimes employed with advantage in hypertrophied conditions of the skin, acting as a discutient upon cutaneous tubercules. When swallowed, it acts as a powerful corrosive poison, the symptoms and treatment being similar to those of poisoning by hydrochloric acid.

Antimonii Oxidum (SbO_3 or Sb_2O_3). *Synonyms:* Oxide of Antimony—Teroxide of Antimony—Sesquioxide of Antimony—Flowers of Antimony.

Preparation.—*Take solution of chloride of antimony,* 16 *fluid ounces; carbonate of soda,* 6 *ounces; water,* 2 *gallons; distilled water, a sufficiency. Pour the antimonial solution into the water, mix thoroughly, let the precipitate settle, and remove the supernatant liquid by a siphon, add one gallon of distilled water, agitate well, let the precipitate subside, again withdraw the fluid, and repeat the processes of affusion of distilled water, agitation, and subsidence. Add now the carbonate of soda previously dissolved in two pints of distilled water, leave them in contact for half-an-hour, stirring frequently, collect the deposit on a calico filter, and wash with boiling distilled water until the washings cease to give a precipitate with a solution of nitrate of silver acidulated by nitric acid. Lastly, dry the product at a heat not exceeding* 212°.

Rationale.—When the solution of chloride of antimony is thrown into water, teroxide of antimony is formed ($2SbCl_3 + 3H_2O = 6HCl + Sb_2O_3$), which, as it falls, carries along with it a variable quantity of unchanged terchloride; so that the first precipitate consists of oxychloride of antimony or *Algarotti's powder;* by repeated affusions most of the terchloride

is converted into teroxide, and what remains is finally decomposed by the solution of carbonate of soda : $2SbCl_3 + 3Na_2CO_3 = 6NaCl + 3CO_2 + Sb_2O_3$. Any adherent chloride of sodium is removed by the washings, as proved by the nitrate of silver test.

CHARACTERS.—*A greyish-white powder fusible at a low red heat, insoluble in water, but readily dissolved by hydrochloric acid.*[1] *The solution, dropped into distilled water, gives a white deposit,*[2] *at once changed to orange by sulphuretted hydrogen.*[3]

PURITY TEST.—*It dissolves entirely when boiled with an excess of the acid tartrate of potash.*[4]

[1] Forming chloride of antimony, $SbCl_3$. [2] Oxychloride of antimony. [3] Being changed into hydrated tersulphide. [4] Forming soluble tartar emetic.

PULVIS ANTIMONIALIS—ANTIMONIAL POWDER.—*Take of oxide of antimony,* 1 *ounce ; phosphate of lime,* 2 *ounces. Mix them thoroughly.*

This is a white, tasteless, inodorous powder, and is the officinal representative of the empirical and patented *James's fever powder,* which has for so many years been held in high estimation. Opinions differ as to the constitution of James's powder, but most of the samples analysed appeared to consist of a small quantity of oxide of antimony, with a trace of antimonite of lime, the bulk of the powder being made up of inert antimonious acid and phosphate of lime. The officinal powder consists of one portion of oxide of antimony to two of the precipitated phosphate of lime, and has not, in consequence of the phosphate being prepared by precipitation, the gritty taste of the old antimonial powder.

Dose.—Of the oxide, three to ten grains, in powder or pill, of antimonial powder, two to five or ten or more grains, but the larger doses, unless approached by degrees, may cause vomiting ; it may be given in powder or pills. The previous antimonial powders, from the method of their preparation, were of very uncertain strength, and were given in doses which it would be dangerous to adopt with the present uniform powder.

Oxide of antimony and antimonial powder in small doses of two or three grains act as alteratives, in somewhat larger doses as diaphoretics, and in still larger doses as emetics and irritants. Their action and uses resemble those of tartar emetic, but being less soluble they are also less energetic. As alteratives they are useful in the treatment of chronic skin diseases ; and as diaphoretics they are employed in such febrile and inflammatory cases as are relieved by sweating. Antimonial powder has been recommended in gradually increasing doses to avert apoplexy.

Antimonium Tartaratum ($KO,SbO_3,C_8H_4O_{10} + 2HO$, or $KSbC_4H_4O_7H_2O$). *Synonyms:* Tartarated Antimony—Tartarised Antimony—Antimonii Potassio-Tartras—Antimonii et Potassæ Tartras—Tartrate of Antimony and Potash—Stibiated Tartar—Tartar Emetic—Kalium Oxidatum Tartaricum Stibiatum—Tartre Emètique—Brechweinstein.

PREPARATION.—*Take of oxide of antimony,* 5 *ounces; acid tartrate of potash, in fine powder,* 6 *ounces; distilled water,* 2 *pints. Mix the oxide of antimony and acid tartrate of potash with sufficient distilled water to form a paste, and set aside for twenty-four hours. Then add the remainder of the water, and boil for a quarter of an hour, stirring frequently. Filter, and set aside the clear filtrate to crystallise. Pour off the mother liquor, evaporate to one-third, and set aside that more crystals may form. Dry the crystals on filtering paper at the temperature of the air.*

Rationale.—$2(HKC_4H_4O_6) + Sb_2O_3 = 2(KSbC_4H_4O_7) + H_2O$.

CHARACTERS.—*In colourless transparent crystals, exhibiting triangular facets, soluble in water, and less so in proof spirit. It decrepitates and blackens upon the application of heat.*[1] *Its solution in water gives with hydrochloric acid a white precipitate, soluble in excess, and which is not formed if tartaric acid be previously added.*

[1] The vegetable acid being charred, the residue consists of reduced antimony, carbonate of potash, and carbon. The crystals are octahedrons, with rhombic bases: they effloresce when exposed to the air, and become opaque. More commonly tartar emetic is met with as a white powder. It is inodorous, but has a slightly acid, and at first a somewhat sweetish taste, which speedily becomes nauseous, styptic, and metallic. It is soluble in fourteen parts of cold, and in two of boiling water, also in proof spirit and in wine, but is insoluble in alcohol. Its solution has a slightly acid reaction, and when long kept, is decomposed, and contains vegetable growths, the *Sirocrocis stibica* of Kützing. Hydrochloric, sulphuric, and oxalic acids give white precipitates with the solution; the alkalies, alkaline earths, and their carbonates decompose it. Sulphuretted hydrogen gives an orange-red precipitate of hydrated tersulphide of antimony. Infusion of nutgalls and other vegetable astringent infusions give a precipitate with the solution of tartar emetic, and the precipitate being considered inert, these infusions are employed as antidotes.

PURITY TESTS.—*Twenty grains dissolve without residue in a fluid ounce of distilled water at* 60°, *and the solution gives, with sulphuretted hydrogen, an orange precipitate which, when washed and dried at* 212°, *weighs* 9·91 *grains.*

The precipitate consists of hydrated tersulphide of antimony. In the crystalline form, tartar emetic is generally pure, but may contain crystals of other salts as fraudulent adulterations. In powder, it may contain cream of tartar, oxide of iron, lime, copper, or arsenic.

VINUM ANTIMONIALE.—ANTIMONIAL WINE.—*Take of tartarated antimony,* 40 *grains; sherry,* 1 *pint. Dissolve.* Strength, two grains to the ounce.

UNGUENTUM ANTIMONII TARTARATI—OINTMENT OF TARTARATED ANTIMONY.—*Take of tartarated antimony, in fine powder,* $\frac{1}{4}$ *ounce; simple ointment,* 1 *ounce. Mix thoroughly.*

Dose.—Of the salt, as a diaphoretic or expectorant, from one-twelfth to one-sixth of a grain; as a nauseant and sudorific, a quarter to half-a-grain; as an emetic, one to three grains; as a sedative or contra-stimulant, half-a-grain to two or three grains, frequently repeated, and

cautiously administered, so as not to produce vomiting. Of the wine, as a diaphoretic or expectorant, ten to thirty minims; as a nauseant, one to two drachms; as an emetic, two drachms, repeated at short intervals, or in a full dose of half-an-ounce; but the wine is most useful in small doses. The ointment contains nearly twice as much tartarated antimony as Unguentum Antimonii Tartarizati, *Dub.* Thirty grains may be rubbed in, and be repeated until an eruption appears, and the action may be kept up by anointing fresh parts as the eruption dies away. Tartar emetic may be applied for the same purpose in solution. As an emetic, its action is promoted by the addition of ipecacuanha, and its diaphoretic effects by combination with other diaphoretics, such as nitrate of potash. Opium may be combined with tartar emetic where it is desirable to combat its irritant properties, in cases in which opium is admissible.

Antidotes.—Facilitate the vomiting by the administration of demulcent and oleaginous drinks, or if it be not free, the stomach-pump may be used. Tannic acid and vegetable infusions containing it, as of oak bark or tea, are to be given, with the view of forming a compound of tannate of antimony, which is insoluble in water, and at least renders the poison less active, if not completely inoperative. Subsequently, a judicious combination of antiphlogistic treatment with needful support. Messrs T. and H. Smith, of this city, whose antidote for poisoning by prussic acid has been so long known, have recently proposed the following "*Antidote for Tartar Emetic.*—Mix five fluid drachms and seven minims of *liquor ferri perchloridi* with a few ounces of water; mix in now a cream formed of ninety grains of calcined magnesia, rubbed up with water in a mortar; stir till, after gelatinising, the mixture again gets thin; empty the mixture into a calico or muslin cloth, and press out the liquid; remove the mass from the cloth into a clean mortar, and rub it up with a little water into a smooth cream: in this state it can destroy upwards of twenty grains of tartar emetic."

Tartar emetic, even in small medicinal doses, has produced alarming and occasionally fatal effects in children. Adults, on the other hand, have been known to take large quantities with impunity, probably in consequence of the poison being removed by vomiting before it had produced either powerfully irritant or sedative effects. In over-doses, however, tartar emetic acts chiefly as an irritant, but also somewhat as a corrosive poison. The quantity necessary to a fatal result depends chiefly upon the vomiting and purging that ensue: an ounce has been taken followed by recovery; but, on the other hand, a drachm has proved fatal, and four grains have given rise to alarming symptoms, even when free vomiting and purging followed. The symptoms observable in acute poisoning by tartar emetic, though variable, are usually the nauseous metallic taste of the poison, violent vomiting, with burning pain and constriction of the throat and œsophagus, difficulty of swallowing, and great thirst; pain in the stomach and bowels, and generally free purging; cramps

in the limbs; cold clammy state of the skin, sometimes with a varioloid eruption; flushed, congested, or dusky countenance, husky voice, or complete inarticulation, extreme muscular depression, with small, weak, and frequent, or imperceptible pulse, delirium, death. There is, however, when prompt treatment is applied, a strong tendency to recovery in acute poisoning by tartar emetic. Tartar emetic has frequently been employed for criminal purposes in small doses long continued, the intention being to induce the belief that the victim suffers from typhoid fever: the symptoms of chronic poisoning are chiefly nausea, vomiting, purging, small and frequent pulse, great muscular depression and weariness, a cold and clammy state of the surface, and general emaciation and exhaustion.

Medicinally, tartar emetic is employed as a diaphoretic, expectorant, nauseant, sedative of the vascular system, contra-stimulant, emetic, counter-irritant, &c., and occasionally it operates as a cathartic. It is contra-indicated in all cases of genuine debility, and as an emetic is unsuited to cases which will not bear depression. It operates as an emetic, when given in sufficient doses, by whatever channel it is introduced into the system, whether by the stomach or rectum, or injected into a vein; and consequently it is sometimes administered by one of the latter methods to produce vomiting, and thereby to discharge impacted substances from the œsophagus. When given in quantities insufficient to cause vomiting, its administration is followed by a distinct diminution both in the force and frequency of the pulse, and likewise in the number of respirations; subsequently, it increases the activity of one or other of the secreting organs, acting either as a diaphoretic, diuretic, expectorant, or cholagogue. Those who, after the fashion of Rasori, follow the doctrine of counter-stimulation, employ tartar emetic as a contra-stimulant or sedative, and administer it as an antiphlogistic in febrile and inflammatory cases. For this purpose it is given in very large doses, beginning with a grain, and rapidly increasing the quantity until as much as from twenty to thirty or more grains are given in the twenty-four hours. The *tolerance* of these quantities is said to be *established* after the first few doses; sometimes it causes nausea and vomiting at first, which may be allayed by small doses of opium, and when the quantities given are large, it may cause purging. Tartar emetic has been given in continued, remittent, and intermittent fevers; in acute inflammatory attacks, such as pneumonia, in which it has been recommended in large doses, bronchitis, and pleurisy; in croup and laryngitis; in acute rheuma-

tism; in inflammation and dropsies of the joints, in meningitis, in acute and chronic hydrocephalus, in insanity; in delirium tremens, in which it is beneficially combined with an opiate; to check certain internal hemorrhages by subduing the circulation; in gonorrhœa, orchitis, bubo, &c. It is occasionally used to produce muscular prostration in strangulated hernia and dislocations, but is generally superseded by chloroform; also to promote the dilatation of the os uteri in tedious labours, &c. Externally, it is employed as a counter-irritant, causing a pustular, varioloid eruption, which often causes great pain, and is sometimes troublesome to heal. During the late epidemic of cattle plague, when vaccination was recommended as a preventive against it, solutions of tartar emetic were found to have been fraudulently sold instead of vaccine lymph. It is used as a derivative in chronic diseases of the chest and throat, chronic affections of the joints, neuralgia, &c., &c.

ARSENICUM (As = 75)—Arsenic—Arsenik—occurs native in the form of *oxide* and *sulphide*, but more commonly it is in combination with other metals in the form of arseniurets, as of copper, cobalt, nickel, and iron. Metallic arsenic is of crystalline texture, very brittle, and of a steel-grey colour; it tarnishes when exposed to the air, falling into a greyish-black powder, volatilises when heated, and sublimes in closed vessels at a temperature below its fusing point, giving off colourless fumes which have the odour of garlic. At a higher temperature it ignites, burns with a blue flame, and forms arsenious acid. It has a specific gravity of 5·75. It forms acids with oxygen.

Acidum Arseniosum (AsO_3, or As_2O_3). *Synonyms:* Arsenious Acid—Arsenicum Album—White Arsenic—White Oxide of Arsenic—Arsenic Blanc—Weisser Arsenik—Arsenichtesaure.

Commercial arsenious acid, which is obtained by roasting the arseniurets in a reverberatory furnace, is purified for medicinal purposes by the following process:—

Take of arsenious acid of commerce, 100 *grains. Introduce the commercial arsenious acid into a thin porcelain capsule of a circular shape; and having covered this as accurately as possible with a glass flask filled with cold water, apply the heat of a gas lamp. Sublimed arsenious acid will be found adhering to the bottom of the flask. Should a larger quantity be required, the commercial arsenious acid should be sublimed by the heat of a gas lamp or of burning charcoal, from a small Florence flask, the neck of which is passed into a second flask of larger size; and the flask containing the commercial arsenious acid should be furnished with a hood of sheet iron to counteract the cooling influence of the atmosphere. These processes should be conducted in the vicinity of a flue with a good draught, so as to carry off any vapours of arsenious acid which may escape.*

CHARACTERS.—*Occurs as a heavy white powder, or in sublimed masses, which usually present a stratified appearance, caused by the existence of*

separate layers differing from each other in degrees of opacity. When slowly sublimed in a glass tube, it forms minute, brilliant, and transparent octahedral crystals. It is sparingly soluble in water, and its solution gives with ammonio-nitrate of silver a canary-yellow precipitate[1] *insoluble in water, but readily dissolved by ammonia and by nitric acid. Sprinkled on a red hot coal it emits an alliaceous odour.*[2]

[1] Arsenite of silver. [2] Characteristic of vapour of arsenic. Commercial arsenious acid is met with in vitreous masses, which are at first white and translucent, but gradually assume a yellowish colour, and become opaque, the enamel-like opacity proceeding gradually from the surface to the centre, so that when the masses are broken, a central transparent portion may occasionally be met with, which on exposure soon becomes opaque like the rest. It is inodorous, and at first tasteless, but has an after-taste sweetish, and somewhat rough or astringent. When slowy sublimed, as in an open tube, the vapour recondenses into octahedral crystals, but when rapidly sublimed it condenses into a sub-crystalline white powder. Cold water dissolves from one-thousandth to one-four-hundredth of its weight. Boiling water, when allowed to cool upon it, takes up about one-four-hundredth part of its weight; but water that is boiled with it for an hour and allowed to cool, retains about one-fortieth part of its weight. Ammonio-sulphate of copper gives a green precipitate of the arsenite of copper, with solutions of arsenious acid. Solution of arsenious acid, previously acidulated with hydrochloric or sulphuric acid, gives with sulphuretted hydrogen a yellow precipitate of sulphide of arsenic, which is insoluble in hydrochloric acid, but is soluble in ammonia, and yields metallic arsenic when heated with powdered ferrocyanide of potassium.

PURITY TESTS.—*It is volatilized at a temperature not exceeding* 400°. *Four grains of it dissolved in boiling water with eight grains of bicarbonate of soda discharge the colour of* 808 *grain-measures of the volumetric solution of iodine.*[1]

[1] Forming arseniate of soda and iodide of sodium, both of which are colourless. Arsenious acid is generally tolerably pure, but may contain sulphate of baryta, or sulphate or carbonate of lime, or oxide of iron; which are not volatilised by heat.

LIQUOR ARSENICALIS—ARSENICAL SOLUTION—LIQUOR POTASSÆ ARSENITIS—FOWLER'S SOLUTION—TASTELESS AGUE DROP.—*Take of arsenious acid, carbonate of potash, of each,* 80 *grains; compound tincture of lavender,* 5 *fluid drachms; distilled water, a sufficiency. Place the arsenious acid and the carbonate of potash in a flask with ten ounces of the water, and apply heat until a clear solution is obtained. Allow this to cool. Then add the compound tincture of lavender, and as much distilled water as will make the bulk one pint.*

CHARACTERS.—*A reddish liquid, alkaline to test paper, and having the odour of lavender. Specific gravity,* 1·009.

TESTS.—*After being acidulated with hydrochloric acid, it gives, with sulphuretted hydrogen, a yellow precipitate,*[1] *which is brightest when the arsenical solution has been previously diluted.* 441·5 *grains by weight* (1 *fluid ounce*) *boiled for five minutes with ten grains of bicarbonate of*

soda, and when cold diluted with six fluid ounces of water to which a little mucilage of starch has been added, does not give with the volumetric solution of iodine a permanent blue colour until 808 *grain-measures have been added; corresponding to four grains of arsenious acid in one fluid ounce.*[2]

[1] Tersulphide of arsenic. [2] Arseniate of soda and iodide of sodium are formed, and so long as there is arsenious acid to be converted into arsenic acid by the oxygen of the soda, so long will there be sodium set at liberty to unite with the iodine; but when there is no more sodium liberated, the iodine will unite with the starch, and give the characteristic blue colour. This test shows the strength of the solution to be as nearly as possible four grains to the ounce.

LIQUOR ARSENICI HYDROCHLORICUS—Hydrochloric Solution of Arsenic. *Synonym:* De Valengin's Solution.

Take of arsenious acid in powder, 80 *grains; hydrochloric acid,* 2 *fluid drachms; distilled water, a sufficiency. Boil the arsenious acid with the hydrochloric acid and* 4 *ounces of the water until it is dissolved, then add distilled water to make the bulk up to one pint.*

Characters.—*A colourless liquid, having an acid reaction. Specific gravity,* 1·009.

Tests.—*Sulphuretted hydrogen gives at once a bright yellow precipitate.*[1] 441·5 *grains by weight* (1 *fluid ounce*) *boiled for five minutes with* 20 *grains of bicarbonate of soda, and then diluted with* 6 *fluid ounces of distilled water, to which a little mucilage of starch has been added, does not give with the volumetric solution of iodine a permanent blue colour until* 808 *grain-measures have been added; corresponding to four grains of arsenious acid in one fluid ounce.*[2]

Rationale.—[1] Tersulphide of arsenic. [2] For explanation of this test, see above under Liquor Arsenicalis. There is double the quantity of the bicarbonate, which is used for the Liquor Arsenicalis, required for this preparation, because the free hydrochloric acid exhausts a certain proportion of the bicarbonate, forming chloride of sodium and free carbonic acid, and consequently renders this quantity unavailable for the test.

This preparation is of the same strength as the Liquor Arsenicalis, and nearly three times the strength of the Liquor Arsenici Chloridi of the London Pharmacopœia, or De Valengin's solution. It is most probably not a chloride of arsenic, but simply a solution of arsenious acid in water, whose solvent power is increased by the addition of hydrochloric acid. Its action is similar to the Liquor Arsenicalis, but some practitioners believe it superior to the latter. De Valengin's solution is reputed to be less irritating than Fowler's solution, and consequently less apt to have its therapeutical uses interfered with by gastric derangement. This result, however, is most probably owing to its being much weaker.

Dose.—Of arsenious acid, a twentieth to an eighth of a grain, in pill or solution; of Liquor Arsenicalis, and of Liquor Arsenici Hydrochloricus, two to five, or cautiously up to ten minims. It is better to give the doses after meals, to avoid the risk of irritating the stomach.

Antidotes.—If vomiting is not caused freely by the poison, an emetic

or the stomach-pump must be employed promptly; demulcent drinks; a mixture of equal parts of oil and lime-water; magnesia; hydrated peroxide of iron, freshly prepared, in quantities equal to at least twelve times that of the poison swallowed, distributed in frequently-repeated doses, so long as there is the possibility of any undissolved poison adhering to the stomach. Messrs T. & H. Smith, of this city, have recently proposed the following ready method of preparing an "*Antidote for arsenious acid.*—Measure out five fluid drachms and seven minims of liquor ferri perchloridi into two or three ounces of water, then add to the liquid a solution of one ounce of crystallised carbonate of soda in a few ounces of warm water; stir till effervescence ceases: the resulting mixture destroys about ten grains of arsenious acid." Their antidote for tartar emetic, already quoted, may also be employed for arsenious acid, of which it absorbs about ten grains.

Arsenious acid has so commonly been employed for criminal purposes, that an act of Parliament was passed to prevent the sale of it unless coloured either by soot or indigo; and although a certain immunity from its effects is known to be obtained by the peasants in Styria, still we can regard it only as a powerful irritant poison when taken in over-doses. It is difficult to state the smallest dose that may prove fatal, as so much depends upon the condition of the stomach, as to food, at the time it is swallowed, and the vomiting which follows. Even medicinal doses sometimes give rise to alarming symptoms, and two grains in solution would possibly prove fatal; but, on the other hand, half-an-ounce has been taken, followed by free vomiting, without producing serious results. The poisonous effects of arsenic may also ensue upon its external application; several fatal cases have occurred from the employment of arsenious acid as an escharotic, even when used in very small quantity. In acute poisoning by arsenic, the symptoms—which may supervene within a few minutes of the swallowing of the poison, or not until half-an-hour or an hour afterwards, or, though more rarely, not until several hours have elapsed—usually commence with a feeling of nausea, depression, and faintness, followed by severe burning pain in the stomach, which is increased by pressure; this is followed by severe vomiting and purging, the vomited matters becoming dark, grumous, and often bloody, or yellowish or greenish from the admixture of bile, whilst the alvine evacuations frequently contain much blood and mucus. The urine is often scanty, high coloured, and mixed with blood; its passage is attended with great pain, and the patient suffers more or less from uncontrollable priapism. There is a feeling of heat and constriction in the fauces and gullet; intense thirst; cramps in the legs; the vomiting becomes more

violent; the abdomen becomes swollen and hard; there is severe pain in the bowels, with tenesmus and continued purging; the pulse is thready and irregular; the surface of the body may be either hot, or cold and clammy; the breathing is laboured, and as much as possible thoracic, so as to avoid movement of the abdomen, and pressure upon the inflamed stomach and bowels; extreme prostration and faintness; more or less of paralysis, with alternations of spasmodic movements, delirium, distressing hiccough, death. There are some very rare cases in which no symptoms of gastro-enteric inflammation are present, there is no pain in those regions, and the patient appears to sink from extreme nervous depression, death being ushered in either by syncope, coma, or convulsions, with intervals of delirium. Death may take place at any time from two hours to several days after swallowing the poison. The symptoms of poisoning by arsenic are generally manifested more slowly, the taste of the poison is less marked, the heat and constriction of the gullet are less intense, the evacuations are less frequently mixed with blood, and the urinary organs are less implicated, than in poisoning by *corrosive sublimate.* In slow or chronic arsenical poisoning, or when unduly continued as a medicine, there is usually considerable irritation of the mucous membrane of the alimentary canal, pain in the stomach and bowels, nausea or vomiting, and free purging, accompanied by tormina and tenesmus; the tongue is furred and dry; there is a burning sensation and a feeling of constriction in the fauces and gullet, with intense thirst, and occasional spitting of blood; the pulse becomes wiry and rapid; there is gradual emaciation, the eyes become red and suffused, and there is intolerance of light; the eyelids are puffy; and the face, and afterwards the limbs, become œdematous; there is frontal headache, nervous tremors or spasms, and a cutaneous vesicular eruption, termed *eczema arsenicale;* and, finally, death may be preceded by convulsions, or more rarely by coma, but usually there is a keen perception of suffering to the last. Arsenic exerts an antiseptic action on the tissues of persons who have died from its poisonous effects.

Medicinally, arsenious acid, administered internally, acts as a nervine tonic, antiperiodic, and alterative; and applied externally, as a stimulant, irritant, and escharotic. As a *tonic*, it is specially useful in nervous diseases of a spasmodic character, such as epilepsy, chorea (for which it is the best remedy known), spasmodic asthma, hay fever, emphysœma, coryza, tetanus, &c.; also in atonic dys-

pepsia, in certain forms of vomiting, in chronic diarrhœa, where the bowels tend to move immediately after meals, and the stools consist of half-digested food. As an *antiperiodic*, it is second only to quinine, and is employed in the treatment of intermittent fever and various recurrent neuralgias, as tic-douloureux, hemicrania, &c. Unlike quinine, it may be administered during the paroxysms of ague. As an *alterative*, it is administered in various diseases of the skin, but is most useful in the scaly class, as in the various species of psoriasis. It is often beneficial also in chronic eczema, impetigo, pompholyx, pemphygus, and in the class tubercula. It is likewise recommended in the treatment of chronic rheumatism and rheumatoid arthritis, especially in those cases in which the small joints are affected; in certain vesicular and ulcerative diseases of the mouth and throat, as in cancrum oris, lupus exedens, &c.

Inhalation of arsenic, by means of cigarettes saturated in a solution containing from ʒss. to ʒj. of arsenite of soda, is recommended by Trousseau in the treatment of phthisis pulmonalis. Arsenic is also strongly recommended as an antidote to the bites of poisonous animals. In weak states of the system, as in the course of phthisis, when dropsy of the cellular tissue supervenes, arsenic is often beneficial in removing the anasarca, acting apparently as a tissue stimulant. Arsenic requires to be administered in carefully-increased doses, and to be stopped, or at once diminished, if the conjectivæ become œdematous or red, or if the bowels become loose. A silvery whiteness of the tongue, originally pointed out by Dr Begbie, is one of the first signs that the system has been got fairly under the influence of arsenic. Externally, arsenious acid acts as a stimulant to the skin, and is a not infrequent constituent of various cosmetics.

It is applied as an escharotic in the destruction of lupus exedens, cancerous masses, parts bitten by poisonous animals, onychia maligna, &c. Its use is not unattended by danger from absorption of the poison, but the risk is made much less if a strong paste is used in preference to a weak one. It acts by setting up destructive inflammation in the part, and if the irritation produced is sufficiently intense, absorption does not take place. Arsenic is almost invariably the principal ingredient in the specifics of cancer-curing quacks. Solutions of arsenic in glycerine, gr. i.–ii. in ℥j., form very effective antiparasitic applications in the treatment of ringworm both of the head and of the body, and also in other epizoic skin diseases.

Sodæ Arsenias ($2NaO,HO,AsO_5+14HO$, or $Na_2HAsO_47H_2O$)—Arseniate of Soda.

PREPARATION.—*Take of arsenious acid,* 10 *ounces; nitrate of soda,* $8\frac{1}{2}$ *ounces; dried carbonate of soda,* $5\frac{1}{2}$ *ounces; boiling distilled water,* 35 *fluid ounces. Reduce the dry ingredients separately to fine powder, and mix them thoroughly in a porcelain mortar. Put the mixture into a large clay crucible, and cover it with the lid. Expose to a full red heat, till all effervescence has ceased, and complete fusion has taken place. Pour out the fused salt on a clean flagstone, and as soon as it has solidified, and while it is still warm, put it into the boiling water, stirring diligently. When the salt has dissolved, filter the solution through paper, and set it aside to crystallise. Drain the crystals, and, having dried them rapidly on filtering paper, enclose them in stoppered bottles.*

Rationale.—This salt is analogous in constitution to phosphate of soda. In the above process the nitrate of soda is decomposed, and gives up a part of its oxygen to convert the arsenious acid into arsenic acid; at the same time the carbonate of soda is likewise decomposed, giving off its carbonic acid, which causes the effervescence: there are then two atoms of soda free, which, with one atom of basic water, supply the wants of the tribasic acid. The following is the simplest formula for the representation of the changes which take place; but opinions vary as to the exact constitution of the salt:—$As_2O_3 + 2(NaNO_3) + Na_2CO_3 + H_2O = N_2O_3 + CO_2 + 2(Na_2HAsO_4)$.

CHARACTERS.—*In colourless transparent prisms, soluble in water; the solution is alkaline, giving white precipitates with chloride of barium,*[1] *chloride of calcium,*[2] *and sulphate of zinc,*[3] *and a brick-red precipitate with nitrate of silver,*[4] *all of which are soluble in nitric acid.*

TESTS.—*Heated to* 300° *it loses* 40·38 *per cent. of its weight.*[5] *A watery solution of* 10 *grains of the residue, treated with* 53 *grain-measures of the volumetric solution of soda, continues to give a precipitate with the volumetric solution of nitrate of silver, until* 1613 *grain-measures of the latter have been added.*[6]

Forming arseniates of baryta,[1] lime,[2] zinc,[3] and silver.[4] [5] Due to the expulsion of its water of crystallisation. [6] Forming arseniate of silver: if impurities were present, less of the volumetric solution would be required. The crystals are efflorescent and inodorous, but have an acrid taste.

LIQUOR SODÆ ARSENIATIS—SOLUTION OF ARSENIATE OF SODA.—*Take of arseniate of soda (rendered anhydrous by a heat not exceeding* 300°), 4 *grains: distilled water,* 1 *fluid ounce. Dissolve.* The salt crystallises with a variable quantity of water; hence, for uniformity of strength, it is necessary to drive off all the water before preparing the solution.

Dose.—Of the crystallised salt, from one-sixteenth to one-eighth of a grain; of the anhydrous salt, one twenty-fifth to one-twelfth of a grain, in pill or in solution; but it is rarely used otherwise than as the officinal solution, of which the dose is five to ten minims.

Arseniate of soda is much used on the Continent. It may be employed instead of arsenious acid or *liquor arsenicalis,* for it is

often found that one preparation of arsenic will cause irritation when another will be readily borne, and the arseniate of soda is said to be less irritating than the arseniate of potash.

Ferri Arsenias—Arseniate of Iron—Arseniate of Iron ($3FeO, AsO_5$, or $Fe_3As_2O_8$), partially oxidised.

PREPARATION.—*Take of sulphate of iron,* 9 *ounces; arseniate of soda, dried at* 300°, 4 *ounces; acetate of soda,* 3 *ounces; boiling distilled water, a sufficiency. Dissolve the arseniate and acetate of soda in two pints, and the sulphate of iron in three pints of the water, mix the two solutions, collect the white precipitate which forms, on a calico filter, and wash until the washings cease to be affected by a dilute solution of chloride of barium. Squeeze the washed precipitate between folds of strong linen in a screw press, and dry it on porous bricks in a warm-air chamber whose temperature shall not exceed* 100°.

Rationale.—($2Na_2HAsO_4 + 3FeSO_4 + 2NaC_2H_3O_2 = 2HC_2H_3O_2 + 3Na_2SO_4 + Fe_3As_2O_8$). The object of the acetate of soda is simply to provide soda to saturate the third atom of sulphuric acid; if it were not so, there would be an atom of sulphuric acid at liberty, which would interfere with the preparation of the desired salt; as it is, two atoms of acetic acid are set at liberty, which are harmless, and, together with the sulphate of soda, are removed by the washings.

CHARACTERS.—*A tasteless amorphous powder of a green colour,*[1] *insoluble in water, but readily dissolved by hydrochloric acid. This solution gives a copious light-blue precipitate with the yellow prussiate of potash,*[2] *and a still more abundant one of a deeper colour with the red prussiate of potash.*[3] *A small quantity boiled with an excess of caustic soda, and filtered, gives, when exactly neutralised by nitric acid, a brick-red precipitate on the addition of solution of nitrate of silver.*[4]

TESTS.—*The solution in hydrochloric acid when diluted gives no precipitate with chloride of barium.*[5] *Twenty grains dissolved in an excess of hydrochloric acid diluted with water continue to give a blue precipitate with the red prussiate of potash, until at least* 170 *grain-measures of the volumetric solution of bichromate of potash have been added.*[6]

[1] At first, when it consists entirely of arseniate of the protoxide of iron, it is white, but even during the process of washing it is partly converted into arseniate of the peroxide of iron, and assumes a dirty green colour. [2 & 3] The solution gives, with the yellow prussiate of potash, a blue precipitate, which is more or less dark according to the proportion of persalt of iron present; and with the red prussiate of potash a deep blue precipitate, which will appear more or less green-coloured when the iron is much oxidated. [4] The precipitate is arseniate of silver. [5] Absence of sulphates. [6] Proving that it contains the proper per-centage of protoxide of iron.

Dose.—From one-sixteenth to one-eighth of a grain, in pill.

Arseniate of iron acts as a tonic and alterative, and is employed in cases in which the double effects of iron and arsenic are desired, as in certain obstinate chronic skin diseases occurring in anæmic

subjects. Externally, it has been used as an escharotic, but its use is dangerous.

AMMONIÆ ARSENIAS—Arseniate of Ammonia—may be prepared by saturating a concentrated solution of arsenic acid with a strong solution of ammonia. From this solution colourless transparent oblique rhombic prisms are gradually deposited ; they effloresce in air, and give up ammonia. Arseniate of ammonia is soluble in water and in alcohol, is exceedingly poisonous, and acts medicinally as an alterative in obstinate chronic skin diseases.

Dose.—From one-twentieth to one-tenth of a grain, in pill or in solution.

QUINIÆ ARSENIS—Arsenite of Quinia—May be prepared by first precipitating quinia from its sulphate, and then boiling it with arsenious acid. It crystallises in plumose tufts of white acicular crystals, which are soluble in boiling but not in cold water. This salt is supposed to possess the twofold antiperiodic properties of quinia and arsenic.

Dose.—From one-tenth to half-a-grain, in pill.

ARSENICI IODIDUM (AsI_3)—Iodide of Arsenic—Teriodide of Arsenic—Hydriodate of Arsenic—Ioduret of Arsenic—may be prepared by reducing sixty grains of metallic arsenic to a fine powder and rubbing it in a mortar with three hundred grains of iodine; the mixture is then fused by heating it very gently in a flask upon a sand-bath, and in this state is poured out upon a slab, and when cold and solidified it is broken up and kept in a well-stoppered bottle. Iodide of arsenic is met with either as a tasteless and inodorous orange-red crystalline solid, or as an orange-red powder. It is perfectly soluble in water, is soluble in boiling but not in cold alcohol. It is entirely volatilised by heat, and readily decomposes when exposed to the atmosphere, or put into water. It is employed as an alterative chiefly in chronic cutaneous diseases associated with scrofulous cachexia. It has been given internally, and at the same time applied in the form of ointment locally, in cancer of the breast, in which cases it is said to allay pain, and to arrest the progress, if not to diminish the size, of the tumour, whilst at the same time it improves the general health. *Dose,* from one-twelfth to one-quarter of a grain, in pill. It is contained in the

LIQUOR ARSENICI ET HYDRARGYRI IODIDI—Solution of the Iodides of Arsenic and of Mercury (Donovan's Solution)—Liquor Arsenici et Hydrargyri Hydriodatis—Solution of the Hydriodates of Arsenic and of Mercury—Solution of the Iodo-Arsenite of Mercury).—Of this compound preparation each fluid drachm contains, either in the form of iodides or hydriodates, what is equal to one-twelfth of a grain of arsenic, one-fourth of a grain of mercury, and three-fourths of a grain of iodine. It may be given in doses of ten to twenty or thirty minims, sufficiently diluted, as an alterative in chronic cutaneous diseases, especially of the squamous kind, and those of syphilitic origin.

HYDRARGYRUM (Hg=100, or 200—*ὕδωρ*, *water*, and *ἄργυρος*,

silver)—Mercury—Quicksilver—Argentum Vivum et Liquidum—Mercure—Vif-Argent—Quecksilber.

CHARACTERS AND TESTS.—*A metal, fluid at common temperatures, brilliantly lustrous, and easily divisible into spherical globules. Volatilises at a heat below that of visible redness, leaving no residue.*

It is met with to a small extent in native globules, also in combination with chlorine, as the chloride of mercury or *horn mercury;* in the form of *amalgam* with silver, &c.; but the principal ore is the *sulphide* or *native cinnabar* (HgS), from which metallic mercury is obtained by distillation. Mercury is a brilliant bluish-white or silvery-white inodorous and tasteless metal. It is fluid at ordinary temperatures, freezes at 40°, and boils at 660°. It is very heavy, having a specific gravity, at 60°, of 13·56. It may contain lead, tin, zinc, bismuth, &c., as impurities. When pure, it is not affected when freely exposed to the air, but when contaminated it becomes covered with a gray powder, has a dull instead of a lustrous appearance, does not quickly form spherical globules when broken, and when run over white paper it leaves a trail behind. Mercury forms two oxides—the one a suboxide or dioxide, Hg_2O, the other an oxide, or peroxide, HgO, both of which are salifiable, and form distinct series of salts.

The difference of opinion existing among chemists respecting the atomic weight of mercury, some holding it should be 100, and others maintaining it ought to be 200, led to considerable risk of confounding, in physicians' prescriptions, the lower oxide of mercury, and the salts related to it, with the higher oxides and its cognate preparations. Thus calomel, on the one view, was a subchloride, and on the other a chloride; while, on the other hand, corrosive sublimate was either a chloride or bichloride. And it is easy to see that very serious consequences must follow if chloride of mercury were written for calomel, and dispensed as corrosive sublimate. To obviate this danger, the Pharmacopœia recommends the use of the names derived, not from the chemical, but from the physical properties of the preparations, namely, red oxide of mercury, green iodide, and red iodide of mercury, and as regards the chlorides, that calomel should be called the subchloride, and corrosive sublimate the perchloride.

It is quite beyond the limits of the *Note-Book* to enter into the questions respecting the actions, uses, and abuses of mercury; the following summary will suggest a further inquiry:—1. Pure metallic mercury is probably inert in the system, and only becomes operative when it is oxidised or salified. 2. All the compounds of mercury are more or less active, but they differ widely in the promptness and intensity of their action: possibly the sulphides are inert. 3. It has been suggested that all the preparations of mercury must be converted

into corrosive sublimate before they can act upon the system, and that their relative efficiency as medicines, and their activity as poisons, depend upon the readiness with which they can be made to assume that form. 4. The topical action of the various mercurial preparations differs widely; with some of them it is scarcely perceptible, whilst with others it is both irritant and caustic. 5. In their general actions, mercurials in small repeated doses increase the activity of the secreting, exhaling, and secerning organs; the bile, pancreatic juice, and saliva are increased in quantity, the skin and the mucous membranes exhale more freely, and the alvine evacuations, the urine, and the catamenia are rendered more copious. At the same time, the absorbents are quickened, so that collections of fluid, the products of inflammation and glandular swellings, are diminished or completely removed. When continued in these, or used in larger doses, purging will follow, unless it be checked by combination with opiates, the effects already mentioned will be intensified, but the salivary glands will be chiefly affected, constituting mercurial salivation, or ptyalism. 6. Many evil consequences may arise from the undue continuance or the abuse of mercurials; but, doubtless, many untoward circumstances which have arisen as mere coincidences during their exhibition have unworthily been laid to their charge. The following are the principal evils that are said to be the effects of mercury in the system: α. *Excessive salivation* (the *ptyalismus stomachalis mercurialis* of Dieterich); β. *Mercurial purging*, or *diarrhœa mercurialis;* γ. *Mercurial palsy*, *tremblement métallique*, *tremblement mercuriel* or *tremor mercurialis*, which begins with a tremulous, unsteady, and ultimately convulsive state of the muscles of the arms; when associated with stammering, it constitutes the *psellismus metallicus;* this condition is common amongst the manufacturers of mirrors, who work amidst the vapours of mercury; δ. *Mercurial erithism*, in which there is great depression of the vital powers, with a tendency to fatal syncope; it is a phase of the *febris mercurialis* of Dieterich, the *febris adynamica;* the other variety, the *febris erethica* or *salivosa*, usually precedes a critical discharge, either by salivation, diarrhœa, or diaphoresis; ε. *Eczema*, or *miliaria mercurialis*, and other cutaneous diseases; ϑ. *Urorrhœa mercurialis*, or polyuria, *hydrosis mercurialis*, or profuse sweating, *apoplexia mercurialis*, *asthma mercurialis*, *amaurosis mercurialis*, *hypochondriasis mercurialis*, *neuroses mercurialis*, *stomatitis mercurialis*, *parotitis mercurialis*, &c., &c. 7. The general indications in the treatment of mercurialism, after stopping the use of the drug, are

to preserve the patient from exposure to cold and damp, without keeping the body too warm ; to allay internal pain by opiates and soothing applications ; to reduce inflammatory symptoms by the cautious use of local depletion and antiphlogistics ; to allay febrile symptoms by mild saline purgatives or effervescing salines ; to employ diffusible stimulants if there be great weakness or threatening syncope ; to apply weak vegetable or mineral astringent lotions, or a lotion of chlorate of potash, to the mouth and throat when there is profuse salivation ; to correct fetor of the breath by a well-diluted gargle or wash of chlorinated soda, or solution of permanganate of potash ; to support the patient by bland, nutritious food ; and finally, to facilitate the removal of the poison from the system, which may be promoted by the use of iodide of potassium. 8. Mercurials are contra-indicated in all cases of genuine debility and impoverished states of the blood, in anæmia, scurvy, hectic, tuberculous and scrofulous diatheses, fatty degeneration of the heart, fatty or granular degeneration of the kidneys, &c. 9. Patients are occasionally met with who manifest the symptoms of mercurialism after the most minute doses of any of the preparations ; these are examples of the influence of idiosyncracy. 10. Mercurialism is not easily established in children ; the drug passes off by the bowels, giving the evacuations the characteristic *chopped spinach* appearance. 11. Mercurials are said to act as alteratives, stimulants, absorbents, deobstruents, sialogogues, antiphlogistics, febrifuges, antisyphilitics, &c. They are given in combination with other purgatives in bilious constipation, dyspepsia and headache, and in jaundice ; in certain febrile affections ; in inflammatory cases, especially those which threaten the life of the patient, or the immediate destruction of an organ, such as peritonitis, pericarditis, croup, iritis, &c. ; in syphilitic affections ; in glandular swellings, in certain forms of dropsy, in rheumatism, &c., &c. 12. Mercurials may be administered by the stomach or by the rectum ; by inhalation of the vapour ; by fumigating the body (protecting the air-passages) either with the dry or moist fumes ; by simple inunction upon the skin, or by the endermic method of first removing the cuticle by a blister, and then dressing the wounded surface with the drug. Infants may be brought under the influence of mercury by wrapping a flannel roller smeared with mercurial ointment round the body. Mercurials may be given in the mild form of minutely divided (and probably oxidised) mercury, as in grey powder, &c. ; in the stronger form of protosalts ; or in the still stronger form of persalts.

HYDRARGYRUM CUM CRETA—Mercury and Chalk—(Grey Powder).—*Take of mercury, by weight,* 1 *ounce; prepared chalk,* 2 *ounces. Rub the mercury and chalk in a porcelain mortar until metallic globules cease to be visible to the naked eye, and the mixture acquires a uniform grey colour.*

This is a heavy insoluble grey powder, containing chalk with finely divided and probably more or less oxidised mercury. It is given to children with rhubarb, or with carbonate of soda, as an alterative, antacid, and purgative, in diarrhœa and cutaneous eruptions, depending upon irritability of the alimentary canal, and as an alterative in syphilis. It is the mildest of the mercurial preparations, and is suitable also, as an alterative, for feeble adults. *Dose,* one to three, four, or more grains. *Hydrargyrum cum Magnesia* contains magnesia instead of chalk, and may be given in the same doses.

PILULA HYDRARGYRI—Mercurial Pill (Blue Pill).—*Take of mercury,* 2 *ounces; confection of roses,* 3 *ounces; liquorice root, in fine powder,* 1 *ounce. Rub the mercury with the confection of roses until metallic globules are no longer visible, then add the liquorice, and mix the whole well together.*

A soft bluish-black mass, containing finely divided and probably partially oxidised mercury. It may be adulterated with Prussian blue or other impurities, and will contain the irritating sulphate of mercury if sulphuric acid had previously been added to the confection of roses, which is sometimes done for the sake of heightening its colour. *Dose,* as an alterative, two or three grains, repeated at intervals according to circumstances; as a cholagogue, added to other purgatives, three to five grains; in doses of ten to fifteen grains, it acts alone as a purgative.

EMPLASTRUM HYDRARGYRI—Mercurial Plaster.—*Take of mercury,* 3 *ounces; olive oil,* 1 *fluid drachm; sublimed sulphur,* 8 *grains; lead plaster,* 6 *ounces. Heat the oil and add the sulphur to it gradually, stirring until they unite; with this mixture triturate the mercury until globules are no longer visible, then add the lead plaster, previously liquified, and mix the whole thoroughly.*

EMPLASTRUM AMMONIACI CUM HYDRARGYRO—Ammoniac and Mercury Plaster.—*Take of ammoniacum,* 12 *ounces; mercury,* 3 *ounces; olive oil,* 1 *fluid drachm; sublimed sulphur,* 8 *grains. Heat the oil, and add the sulphur to it gradually, stirring till they unite. With this mixture triturate the mercury, until the globules are no longer visible; and, lastly, add the ammoniacum previously liquified, mixing the whole carefully.*

These plasters are employed as stimulant and discutient applications to glandular enlargements, over the liver in chronic induration and enlargement; to indolent buboes, syphilitic nodes, &c.

LINIMENTUM HYDRARGYRI—Liniment of Mercury.—*Take of ointment of mercury,* 1 *ounce; solution of ammonia, liniment of camphor, of each* 1 *fluid ounce. Liquify the ointment of mercury in the liniment of camphor with a gentle heat; then add the solution of ammonia gradually, and mix with agitation.*

Employed as a stimulant and discutient application to indolent tumours, chronic enlargement of the joints, &c. It readily produces salivation.

Suppositoria Hydrargyri—Mercurial Suppositories.

PREPARATION.—*Take of ointment of mercury,* 60 *grains; benzoated lard, white wax, of each* 20 *grains; oil of theobroma,* 80 *grains. Melt the benzoated lard, wax, and oil of theobroma with a gentle heat, then add the ointment of mercury, and having mixed all the ingredients thoroughly, without applying more heat, immediately pour the mixture, before it has congealed, into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository.*

Found exceedingly efficacious in destroying ascarides of the rectum, and as a local application for irritable or disordered conditions of the mucous membrane, which occasionally follow operative interference with it. It also presents a much easier method of bringing the system under the influence of mercury than inunction, when for any cause it is deemed inadvisable to administer the drug by the mouth.

UNGUENTUM HYDRARGYRI—OINTMENT OF MERCURY (Blue Ointment).—*Take of mercury, prepared lard, of each,* 1 *pound; prepared suet,* 1 *ounce. Rub them together until metallic globules cease to be visible.*

A soft bluish-black ointment, containing finely divided and probably partially oxidised mercury. It is employed as a discutient to indolent tumours, and, in conjunction with the internal use of mercurials, to produce salivation; for the latter purpose it is rubbed into the most tender parts of the skin, as on the inner sides of the thighs, into the axillæ, &c., or it may be applied endermically to a blistered surface. It has been recommended as an application over deep-seated acute inflammations, in orchitis, in erysipelas, &c.

Unguentum Hydrargyri Compositum—Compound Ointment of Mercury.

Take of ointment of mercury, 6 *ounces; yellow wax, olive oil, of each* 3 *ounces; camphor,* 1½ *ounce. Melt the wax with a gentle heat, and add the oil; then, when the mixture is nearly cold, add the camphor in powder, and the ointment of mercury, and mix the whole thoroughly together.*

This ointment combines the medicinal properties of the mercurial ointment and camphor. The wax and oil are added to give it body, as the combination of camphor with mercurial ointment is too fluid for convenient use. It is used as a stimulant deobstruent ointment in cases of swollen scrofulous glands, chronic buboes, &c.

HYDRARGYRI OXIDUM NIGRUM (Hg_2O)—Black Oxide of Mercury—Suboxide of Mercury—Protoxide of Mercury—is a dark greyish-black, tasteless, and inodorous powder, which is insoluble in water, and is decomposed by the influence of light and air, being converted into metallic mercury and oxide. It may be prepared by throwing calomel into lime water, whereby the subchloride of mercury is precipitated as suboxide, chloride of calcium being formed in solution, $Hg_2Cl_2 + CaO = Hg_2O + CaCl_2$. This constitutes

LOTIO HYDRARGYRI NIGRA—Black Mercurial Lotion. *Synonym:* Black Wash—Aqua Phagedænica Mitis.

Take of subchloride of mercury, 30 *grains; solution of lime,* 10 *fluid ounces. Mix.*

Black wash, though a standard preparation in all hospitals, was never before officinal. Its name sufficiently explains its appearance. It is employed as a mild alterative application to chancres and other syphilitic sores, and also to a variety of non-syphilitic sores, such as cancrum oris, foul and indolent ulcers, &c. The black oxide is sometimes used for fumigation, but is never administered internally. An ointment is sometimes prepared from it, which is used for purposes similiar to those to which black wash is applied.

Hydrargyri Oxidum Rubrum (HgO). *Synonyms:* Red Oxide of Mercury—Hydrargyri Nitrico-Oxidum—Oxide, Binoxide, or Peroxide of Mercury—Red Precipitate—Deutoxide de Mercure—Rothes Quecksilberoxyde.

PREPARATION.—*Take of mercury, by weight,* 8 *ounces; nitric acid,* 4½ *fluid ounces; water,* 2 *fluid ounces. Dissolve half the mercury in the nitric acid diluted with the water, evaporate the solution to dryness, and with the dry salt thus obtained triturate the remainder of the mercury, until the two are uniformly blended together. Heat the mixture in a porcelain dish with repeated stirring, until acid vapours cease to be evolved, and, when cold, enclose the product in a bottle.*

Rationale.—The simplest explanation of this process is that, in the first place, nitrate of mercury is formed, nitric oxide gas being given off, $3Hg + 8HNO_3 = 4H_2O + N_2O_2 + 3(Hg2NO_3)$; and, secondly, that on the addition of more mercury and heating the mixture, the nitric acid is decomposed, an atom of its oxygen going to the mercury, whilst the rest passes off in the form of *acid vapours* (N_2O_4), thus $Hg2NO_3 + Hg = 2HgO + N_2O_4$. Or, otherwise, it may be stated that nitrate of the suboxide of mercury ($Hg_2 2NO_3$) and nitric oxide (N_2O_2) are first formed, and that the former, by the aid of heat, is reconstructed into peroxide of mercury (HgO) and nitric peroxide (N_2O_4), thus: $Hg_2 2NO_3 = N_2O_4 + 2HgO$. The mercury is acted upon in two parts, simply for the sake of economy, in order that the second portion may be oxidised by the nitric acid which is driven off from the nitrate of mercury, and which would otherwise be useless.

CHARACTERS.—*An orange-red powder, readily dissolved by hydro-*

chloric acid, yielding a solution which, with caustic potash added in excess, gives a yellow precipitate,[1] *and with solution of ammonia a white precipitate.*[2]

PURITY TESTS.—*Entirely volatilised by a heat under redness,*[3] *being at the same time decomposed into mercury and oxygen. If this be done in a test-tube, no orange vapours are perceived.*[4]

[1] Of the yellow hydrated peroxide of mercury. [2] Of ammoniated mercury. [3] Brick-dust, oxide of iron, or red lead, if present as impurities, would remain. [4] Absence of nitrate of mercury, the nitric acid of which, when heated, would evolve nitrous acid vapours. The red oxide is commonly met with in brilliant scales, varying in colour from orange-yellow to bright red ; it has a caustic taste, is inodorous, is almost insoluble in water, and is readily decomposed by heat and light.

LOTIO HYDRARGYRI FLAVA—YELLOW MERCURIAL LOTION—YELLOW WASH.—*Take of perchloride of mercury,* 18 *grains; solution of lime,* 10 *fluid ounces. Mix.*

Rationale.—$HgCl_2 + CaO = CaCl_2 + HgO$.

Yellow Wash is simply a solution of peroxide of mercury. It is employed for purposes similar to those for which the red precipitate ointment is used.

UNGUENTUM HYDRARGYRI OXIDI RUBRI—OINTMENT OF RED OXIDE OF MERCURY. *Synonym:* Unguentum Hydrargyri Nitrico-Oxidi, *Lond.* (Red Precipitate Ointment).—*Take of red oxide of mercury, in very fine powder,* 62 *grains; yellow wax,* ¼ *ounce; oil of almonds,* ¾ *ounce. Melt the wax at a gentle heat, mix the oil with it, and when the mixture is nearly cold, add the oxide of mercury, and mix the whole thoroughly together.*

Red oxide of mercury has been given internally in doses of from one-twelfth of a grain upwards, but in consequence of its uncertain character and its irritant poisonous properties, it is very rarely administered. Externally, it is applied, either sprinkled in powder upon the part, or in the form of ointment, as a caustic to unhealthy granulations, chronic indolent ulcers, soft warts, ophthalmia tarsi, chronic conjunctivitis, &c. It may cause salivation.

Hydrargyri Iodidum Viride—(Hg_2I, or HgI)—Green Iodide of Mercury—Subiodide of Mercury—Proto-iodide of Mercury—Iodide of Mercury.

PREPARATION.—*Take of mercury, by weight,* 1 *ounce; iodine,* 278 *grains; rectified spirit, a sufficiency. Rub the iodine and mercury in a porcelain mortar, occasionally moistening the mixture with a few drops of the spirit, and continue the trituration until metallic globules are no longer visible, and the whole assumes a green colour. The product thus obtained should be dried in a dark room, on filtering paper, by simple exposure to the air, and preserved in an opaque bottle.*

Rationale.—A direct combination of the constituents, $2Hg + {}_2I = Hg_2I_2$.

CHARACTERS AND TESTS.—*A dull green powder insoluble in water, which darkens in colour upon exposure to light.*[1] *When it is shaken in a tube with ether, nothing is dissolved.*[2] *Gradually heated in a test-tube, it yields a yellow sublimate, which, upon friction, or after cooling, becomes red, while globules of metallic mercury are left in the bottom of the tube.*[3]

[1] Having a tendency to pass into the red iodide. [2] The red iodide, if present, would be dissolved out by the ether. [3] The yellow sublimate consists of ${}_2HgI$ the red iodide, an atom of metallic mercury being left behind, $Hg_2I_2 = HgI_2 + Hg$. If heated to the boiling point with a little aniline, a magenta colour would be struck if any of the red iodide were present. The green iodide is insoluble in ether, and in solution of chloride of sodium; the red iodide is soluble in both. It is commonly met with as a dull heavy greenish-yellow powder; and for medicinal purposes should be recently prepared, and be preserved from the access of light.

Dose.—One to three grains (one-sixth to one-half of a grain to children), in pill; care being taken to ascertain its freedom from the red iodide, which would cause alarming symptoms. As an ointment, one part to eight of lard. Iodide of potassium might possibly convert it into the red iodide, and therefore should not be given with it.

Green iodide of mercury acts in over-doses as an irritant poison, and in medicinal doses as an alterative and stimulant. It is employed in syphilitic and scrofulous affections, in sarcinous vomiting, in a variety of chronic cutaneous diseases, &c. Externally, it is applied over the seat of chronic inflammations, over the region of the liver in chronic induration of that organ, &c. It may cause salivation.

Hydrargyri Iodidum Rubrum (HgI, or HgI_2)—Red Iodide of Mercury—Iodide of Mercury—Biniodide or Periodide of Mercury.

PREPARATION.—*Take of perchloride of mercury,* 4 *ounces; iodide of potassium,* 5 *ounces; boiling distilled water,* 4 *pints. Dissolve the perchloride of mercury in three pints, and the iodide of potassium in the remainder of the water, and mix the two solutions. When the temperature of the mixture has fallen to that of the atmosphere, decant the supernatant liquor from the precipitate, and, having collected the latter on a filter, wash it twice with cold distilled water, and dry it at a temperature not exceeding* 212°.

Rationale.—A simple interchange of constituents, $HgCl_2 + 2KI = 2KCl + HgI_2$, the former in solution, the latter as a precipitate.

CHARACTERS.—*A crystalline powder of a vermilion colour, becoming yellow when gently heated over a lamp on a sheet of paper;*[1] *almost insoluble in water, dissolves sparingly in alcohol, but freely in ether,*[2] *or in an aqueous solution of iodide of potassium.*[3] *When digested with solution of soda, it assumes a reddish-brown colour,*[4] *and the fluid, cleared by filtra-*

tion and mixed with solution of starch, gives a blue precipitate on being acidulated with nitric acid.[5]

Purity Test.—*Entirely volatilised by a heat under redness.*[6]

[1] If rapidly cooled, its red colour is restored, but when gradually cooled, it remains yellow until rubbed with a hard substance, when it again becomes red. [2] Distinguishing it from the green iodide, which is insoluble. [3] Forming a soluble double salt, $HgI_2 + 2KI$. [4] Iodide of sodium being formed in solution, and red oxide of mercury precipitated, $HgI_2 + Na_2O = 2NaI + HgO$. [5] Characteristic of an iodide. [6] Absence of fixed impurities. It is soluble in a boiling saturated solution of chloride of sodium, and in this also differs from the green iodide. It has a caustic taste, is inodorous, and crystallises in two forms, according to the heat at which it is sublimed.

UNGUENTUM HYDRARGYRI IODIDI RUBRI—Ointment of Red Iodide of Mercury.—*Take of red iodide of mercury, in fine powder,* 16 *grains; simple ointment,* 1 *ounce. Mix thoroughly.*

This ointment contains one-fourth as much red iodide of mercury as unguentum hydrargyri iodidi rubri, *Dub.*

Dose.—One-sixteenth, very cautiously increased to a quarter, of a grain, in pill, or in solution, with iodide of potassium.

Red iodide of mercury acts in over-doses as a powerful irritant poison, resembling corrosive sublimate; and even in medicinal doses it may cause great irritation and salivation. Externally, it acts as a powerful caustic, causing inflammation of the skin when applied to it. In medicinal doses it is alterative, stimulant, and deobstruent. It has been employed in syphilitic and strumous affections, in a variety of cutaneous diseases, in valvular disease of the heart, in epilepsy, in syphilitic rheumatism, in chronic glandular enlargements, &c. Externally, it has been used in bronchocele, in lupus, ophthalmia tarsi, chronic glandular enlargements, &c. Its application to broken surfaces requires great caution, and causes very severe pain.

HYDRARGYRI SUBCHLORIDUM (Hg_2Cl, or $HgCl$). *Synonyms:* Subchloride of Mercury—Calomel—Chloride, Protochloride, Submuriate, Muriate, Mild Muriate of Mercury—Hydrargyri Chloridum Mite—Mercure Doux—Protochlorure de Mercure—Einfach Chlorquecksilber.

Preparation.—*Take of sulphate of mercury,* 10 *ounces; mercury,* 7 *ounces; chloride of sodium, dried,* 5 *ounces; boiling distilled water, a sufficiency. Moisten the sulphate of mercury with some of the water, and rub it and the mercury together until globules are no longer visible; and the chloride of sodium, and thoroughly mix the whole by continued trituration. Sublime by a suitable apparatus into a chamber of such size that the calomel, instead of adhering to its sides as a crystalline crust, shall fall as a fine powder on its floor. Wash this powder with boiling distilled water,*

until the washings cease to be darkened by a drop of sulphide of ammonium. Finally, dry at a heat not exceeding 212°, *and preserve in a jar or bottle impervious to light.*

Rationale.—There is an interchange of constituents between the sulphate of mercury and the chloride of sodium, the result of which alone would be sulphate of soda and corrosive sublimate, $HgSO_4 + 2NaCl = Na_2SO_4 + HgCl_2$; but by the addition of an atom of metallic mercury the subchloride or calomel is formed. $HgSO_4 + Hg + 2NaCl = Na_2SO_4 + 2HgCl$. Or it may be otherwise stated, that the neutral sulphate of the peroxide of mercury ($HgSO_4$), by being rubbed with an atom of metallic mercury, is converted into sulphate of the suboxide of mercury (Hg_2SO_4), which, with the chloride of sodium, gives the desired subchloride of mercury, $Hg_2SO_4 + 2NaCl = Na_2SO_4 + 2HgCl$. Any corrosive sublimate that may be formed during the process is removed by the washings, its entire removal being indicated by the hydrosulphuret of ammonia test. If the chamber into which the sublimed calomel is received be small and warm, the salt will be deposited upon its walls in the form of a fibrous, semi-transparent, sparkling crystalline mass, consisting of quadrangular prisms; if, on the other hand, it be sufficiently large, and be kept cool, a fine powder will be obtained.

CHARACTERS.—*A dull-white, heavy, and nearly tasteless powder, rendered yellowish by trituration in a mortar; insoluble in water, spirit, or ether. Digested with solution of potash, it becomes black;*[1] *and the clear solution, acidulated with nitric acid, gives a copious white precipitate with nitrate of silver.*[2] *Contact with hydrocyanic acid also darkens its colour.*[3]

PURITY TESTS.—*Entirely volatilised by a sufficient heat.*[4] *Warm ether which has been shaken with it in a bottle leaves, on evaporation, no residue.*[5]

[1] Owing to the formation of suboxide of mercury, which is precipitated, chloride of potassium being left in the clear solution. [2] Chloride of silver. [3] Bicyanide of mercury and metallic mercury are found, and the latter gives rise to the darkening in colour. $2HgCl + 2HCy = HgCy_2 + 2HCl + Hg$. [4] Chalk, sulphate of lime, sulphate of baryta, carbonate of lead, or other similar impurity, would be left behind. [5] Ether would dissolve out corrosive sublimate, if present, which would remain on evaporation. When calomel is allowed to condense into a crystalline cake (which when scratched affords a characteristic streak), the powder into which it is afterwards rubbed has a buff colour; but when it is prepared as directed by the Pharmacopœia, it occurs as a dense, white, impalpable, tasteless, and inodorous powder, having a specific gravity of 7·14; it sublimes at a heat below redness, the density of its vapour being 8·2.

PILULA HYDRARGYRI SUBCHLORIDI COMPOSITA—COMPOUND PILL OF SUBCHLORIDE OF MERCURY—PLUMMER'S PILL.—*Take of subchloride of mercury, sulphurated antimony, of each* 1 *ounce; guaiacum resin, in powder,* 2 *ounces; castor oil,* 1 *fluid ounce, or a sufficiency. Triturate the subchloride of mercury with the antimony, then add the guaiacum resin and castor oil, and beat the whole into a uniform mass.*

UNGUENTUM HYDRARGYRI SUBCHLORIDI—OINTMENT OF

SUBCHLORIDE OF MERCURY.—*Take of subchloride of mercury,* 80 *grains; perpared lard,* 1 *ounce. Mix thoroughly.*

Dose.—Of calomel, as an alterative, half-a-grain to two grains; as a purgative, two to six grains; to produce symptoms of mercurialism, one grain, combined with a sixth of a grain of opium, every hour, or in larger doses at longer intervals. It is sometimes given as a sedative in very large doses (twenty to sixty grains); and in still larger doses it is said to act as a powerful diuretic. Of the compound calomel pill, as an alterative and diaphoretic, five to ten or more grains; there is a grain each of calomel and of sulphurated antimony in five grains of the pill. Calomel may be given in pill or in powder, either alone or in combination with other alteratives (as in the compound pill), or purgatives.

Calomel acts as a mild but sure mercurial, and has been taken in very large doses with impunity; but, on the other hand, so small a quantity as five grains has caused fatal salivation, and other deaths have followed the administration of comparatively small quantities. In small doses, calomel acts as an alterative, and as such is given in a variety of cases, including syphilitic and other chronic skin diseases, affections of the liver, glandular enlargements, &c. As an antiphlogistic it is given in febrile and inflammatory affections; as a purgative, it is usually given in combination with other cathartics, whose effects it tends to promote by stimulating the liver and intestinal glands to increased activity, and is employed as such in sluggish states of the liver, with constipation, jaundice, at the outset of inflammatory diseases, &c. In hot climates it is used in large doses as a sedative, as in cholera, dysentery, yellow fever, &c. Plummer's pill is a favourite alterative remedy employed in syphilitic and other chronic skin diseases, in chronic rheumatism, &c. Calomel ointment is applied to chronic cutaneous diseases, &c. Calomel is also frequently added in minute quantity to other remedies, as diaphoretics, diuretics, anthelmintics, &c., to promote their special effects; in short, it is employed for so many purposes that it is quite impossible even to enumerate them within the limited space of the *Note-Book.*

Hydrargyri Perchloridum ($HgCl$ or $HgCl_2$). *Synonyms:* Perchloride of Mercury—Corrosive Sublimate—Hydrargyri Chloridum—Chloride of Mercury—Hydrargyri Bichloridum—Bichloride of Mercury—Oxy-Muriate of Mercury—Corrosive Muriate of Mercury—Deutochloride de Mercure—Bichloride de Mercure—Doppelt Chlorquecksilber.

PREPARATION.—*Take of sulphate of mercury,* 20 *ounces; chloride of sodium, dried,* 16 *ounces; black oxide of manganese, in fine powder,* 1 *ounce. Reduce the sulphate of mercury and the chloride of sodium each to fine powder, and having mixed them and the oxide of manganese thoroughly by trituration in a mortar, put the mixture into an apparatus adapted for*

sublimation, and apply sufficient heat to cause vapours of perchloride of mercury to rise into the less heated part of the apparatus which has been arranged for their condensation.

Rationale.—There is an interchange of constituents between the sulphate of mercury and the chloride of sodium, sulphate of soda and chloride of mercury being formed, the latter of which is separated by sublimation, $HgSO_4 + 2NaCl = Na_2SO_4 + HgCl_2$. The oxide of manganese is employed as a precautionary measure to prevent the production of calomel by the action of the chloride of sodium upon that *sub*sulphate (Hg_2SO_4) which is almost invariably present in the neutral sulphate of mercury; by supplying an equivalent of oxygen the oxide of manganese converts the subsulphate into the sulphate. The heat is to be carefully regulated, in order to prevent the fusion of the sublimate.

CHARACTERS.—*In heavy colourless masses of prismatic crystals, possessing a highly acrid metallic taste, more soluble in alcohol, and still more so in ether than in water. Its aqueous solution gives a yellow precipitate with caustic potash,*[1] *a white precipitate with ammonia,*[2] *and a curdy white precipitate with nitrate of silver.*[3]

PURITY TESTS.—*When heated it sublimes without decomposing, or leaving any residue.*[4]

[1] Yellow hydrated peroxide of mercury. [2] Ammoniated mercury. [3] Chloride of silver. [4] Absence of calomel, sal ammoniac, peroxide of iron, and other insoluble or fixed impurities. Corrosive sublimate occurs in snow-white crystalline masses, consisting of adhering rhombic prisms, or as a white powder. It is inodorous, but has a nauseous, acrid, persistent metallic taste. It is permanent in air; has a specific gravity of 5·4; is readily soluble in ether and in alcohol, and in sixteen parts of cold and in three parts of boiling water. It readily volatilises when heated, and fuses at 509°. By exposure to the light it is decomposed into calomel and metallic mercury; it is also decomposed by many organic substances, and enters into combination with albumen. Its presence may be detected by placing a drop of the suspected solution upon a bright gold coin, and passing a galvanic current through it, by touching both the solution and the gold simultaneously with a piece of bright steel, as a key or the blade of a knife; metallic mercury is at once produced, which, forming an amalgam, leaves a characteristic stain upon the coin. The stain may be removed by heating the coin.

Dose.—From one-sixteenth to one-eighth of a grain, in pill or solution, taken after meals. Externally, from a quarter of a grain to a grain to each ounce of the vehicle, as a lotion.

Antidotes.—Albumen combines with corrosive sublimate, forming a comparatively inert and insoluble compound, but soluble in excess of albumen; therefore raw eggs, both yolk and white, should be given immediately; or in their absence, gluten obtained from flour, wheaten flour mixed with milk or water, or milk alone, until the others are ready; hydrated protosulphuret and hydrated persulphuret of iron have been proposed, but are believed to be useless after the lapse of a quarter of an hour; protochloride of tin and iron filings have also been employed. The stomach-pump is likely to be more mischievous than useful. The main object is the removal of the poison, both before and after the ad-

ministration of antidotes, and this is to be effected by facilitating the vomiting by the use of demulcent drinks, combined with the antidotes, or by the use of emetics, if necessary. Chemical antidotes alone are not to be trusted. Subsequently, salivation and other symptoms are to be treated as they arise.

LIQUOR HYDRARGYRI PERCHLORIDI, Solution of the Perchloride of Mercury. *Synonym:* Liquor Hydrargyri Bichloridi, Lond.

Take of perchloride of mercury, chloride of ammonium, of each 10 *grains; distilled water,* 1 *pint. Dissolve.*

The chloride of ammonium is used simply to increase the solvent power of the water. It is a very useful form for administering the perchloride. One fluid drachm contains $\frac{1}{16}$th of a grain of the salt. The dose is from one to two fluid drachms thrice a-day.

Corrosive sublimate in over-doses acts as a powerful corrosive irritant poison. Three grains have destroyed the life of a child, but much larger doses have been followed by recovery, either in consequence of free spontaneous vomiting, or of the employment of remedial measures. The promptness and energy of the poison will depend upon the state of the stomach with respect to food; if it be swallowed after a meal comparatively little injury may ensue if it be immediately expelled, but when taken on an empty stomach even small medicinal doses are apt to cause great irritation. Death may follow a poisonous dose at any time between three to five or ten hours and five or more days after swallowing it. The symptoms attending acute poisoning by corrosive sublimate are manifested immediately after it is taken, and are more or less as follows:—There is the strong nauseous metallic taste of the poison, a burning heat and a feeling of constriction in the throat and gullet, extending to the stomach, causing painful and difficult swallowing and breathing; the tongue is contracted, and its surface, in common with that of the whole cavity of the mouth, is whitened, and occasionally there are early symptoms of salivation, with swelling of the tongue, gums, and lips; vomiting then follows, and causes great suffering, the vomited matters being mixed with stringy mucus and blood; there is usually intense pain in the region of the stomach, and the whole surface of the abdomen is intolerant of pressure; there is severe purging, the evacuations containing more or less of mucus and blood; the urinary organs are often implicated, the urine being scanty, and its passage very painful; there is great nervous depression, the pulse is small, weak, and frequent, thready and irregular; the face is often flushed and swollen, at other times

shrunken, pale, and anxious, and the surface of the body is cold and clammy; death may be preceded by convulsions, or by stupor, or fatal syncope may occur without them. If the patient survive a few days, salivation, ulceration of the mouth, severe dysenteric purging, and the symptoms arising from destruction of portions of the tissues of the alimentary canal may ensue. Poisoning by corrosive sublimate may take place slowly, by the administration of small doses, and serious effects may follow its external use when applied to broken surfaces. The symptoms of acute poisoning by corrosive sublimate are generally more promptly manifested, the taste of the poison is more marked, the heat and constriction of the gullet are more intense and are present before vomiting commences, the evacuations are more frequently mixed with blood, and the urinary organs are more implicated than in poisoning by *arsenic*.

Medicinally, corrosive sublimate acts as an alterative, seldom producing salivation; it should be given after meals in order to avoid the irritation which it is apt to cause when given on an empty stomach, and if it still cause irritation it may be combined with a little opium. It is given in secondary syphilis, in a variety of chronic syphilitic and other diseases of the skin, in strumous affections, chronic rheumatism, ophthalmia, arthritis, periosteal affections, neuralgia, with or without syphilis, &c. Externally, it acts as an escharotic, and is not without danger, either from the violence of its local effects, or in consequence of its absorption; it has been employed in the solid form as a caustic application to malignant onychia, &c.; and as an alterative lotion, collyrium, or injection, it has been recommended in cutaneous diseases, ophthalmia, prurigo gonorrhœa, gleet, leucorrhœa, &c.

Hydrargyrum Ammoniatum (NH_2Hg_2Cl or NH_2HgCl). *Synonyms:* Ammoniated Mercury—Hydrargyri Ammonio-Chloridum—Ammonio-Chloride of Mercury—Hydrargyri Præcipitatum Album—White Precipitate—Amido-Chloride of Mercury—Hydrargyrum Bichloratum Ammoniatum—Chlorure Ammoniaco Mercuriel Insoluble—Weisser Queckselber Präcipitat.

Preparation.—*Take of perchloride of mercury,* 3 *ounces; solution of ammonia,* 4 *fluid ounces; distilled water,* 3 *pints. Dissolve the perchloride of mercury in the water with the aid of a moderate heat; mix the solution with the ammonia, constantly stirring; collect the precipitate on a filter, and wash it well with cold distilled water until the liquid which passes through ceases to give a precipitate when dropped into a solution of nitrate of silver acidulated by nitric acid. Lastly, dry the product at a temperature not exceeding* 212°.

Rationale.—$HgCl_2 + (NH_4)_2O = NH_2HgCl + NH_4Cl + H_2O$, that is to

say, that one atom of ammonium seizes upon half the chlorine of the sublimate to form chloride of ammonium, which remains in solution; at the same time, the other atom of ammonium is broken up into the hypothetical radical *amidogen* (NH_2) + hydrogen (2H); the oxygen in the original atom of oxide of ammonium, being now liberated, combines with the two atoms of free hydrogen to form water (H_2O), while the amidogen unites with the subchloride of mercury to form the desired double salt (NH_2HgCl), which is thrown down in the form of a white precipitate, and from which all the chloride of ammonium is removed by the washing, as is evidenced by the nitrate of silver test. White precipitate may also be regarded as the result of a combination between sal ammoniac and mercury, in which one atom of the latter is substituted for two atoms of the hydrogen of the former, ($NH_4Cl + Hg = NH_2HgCl + 2H$.)

CHARACTERS.—*An opaque white powder on which cold water, alcohol, and ether, have no action. Digested with caustic potash, it evolves ammonia,*[1] *acquiring a pale yellow colour, and the fluid, filtered, and acidulated with nitric acid, gives a white precipitate with nitrate of silver.*[2] *Boiled with a solution of chloride of tin, it becomes grey, and affords globules of metallic mercury.*[3]

TEST.—*Entirely volatilized at a heat under redness.*[4]

[1] Ammonia is evolved, chloride of potassium is left in solution, and an impure oxide of mercury is formed. [2] Chloride of silver. [3] In consequence of the chloride of tin seizing upon an equivalent of chlorine to become bichloride. [4] Absence of fixed white powders, such as chalk, sulphates of lime, lead, baryta, &c. It is sometimes met with in masses; it is inodorous, but has a disagreeable metallic taste; it is decomposed by heat into calomel, ammonia, and nitrogen, and is resolved by boiling water into sal ammoniac and the yellow hydrated oxide of mercury.

UNGUENTUM HYDRARGYRI AMMONIATI.—OINTMENT OF AMMONIATED MERCURY. Synonym: *Unguentum præcipitati albi*, Ed.— —*Take of ammoniated mercury*, 62 *grains; simple ointment*, 1 *ounce. Mix thoroughly.*

Ammoniated Mercury acts as a powerful irritant poison; it is not used internally. Externally it is used in the form of the *white precipitate* ointment as an application in a variety of skin diseases, in ophthalmia tarsi, to destroy pediculi, &c. *Hydrargyri Iodo-Chloridum*, resembles the ammonio-chloride of mercury in constitution the ammonia being replaced by iodine. It has been employed on the Continent both externally and internally (in doses of one-twentieth to one-tenth of a grain) in cutaneous diseases.

Liquor Hydrargyri Nitratis Acidus—Acid Solution of Nitrate of Mercury—Nitrate of Mercury (HgO,NO_5 or $Hg2NO_3$) in Solution in Nitric Acid.

PREPARATION.—*Take of mercury*, 4 *ounces; nitric acid*, 5 *fluid ounces; distilled water*, $1\frac{1}{2}$ *fluid ounce. Mix the nitric acid with the water in a flask; and dissolve the mercury in the mixture without the application of*

heat. Boil gently for fifteen minutes, cool, and preserve the solution in a stoppered bottle.

Rationale.—Two atoms of nitric acid are decomposed, forming two atoms of nitric oxide, and, at the same time, oxidising three atoms of the mercury, which then gets dissolved, forming, with other six atoms of nitric acid, three atoms of pernitrate of mercury. Eight atoms of hydrogen and four atoms of oxygen set at liberty during the reaction, unite to form four atoms of water; thus:—$Hg_3 + 8HNO_3 = 3Hg2NO_3 + 2NO + 4H_2O$.

CHARACTERS.—*A colourless and strongly acid solution, which gives a yellow precipitate with solution of potash added in excess.*[1] *If a crystal of sulphate of iron be dropped into it, in a little time the salt of iron, and the liquid in its vicinity, acquire a dark colour.*[2]

PURITY TEST.—*Specific gravity,* 2·246. *Does not give any precipitate when a little of it is dropped into hydrochloric acid diluted with twice its volume of water.*[3]

[1] Yellow hydrated peroxide of mercury, indicating the presence of a persalt of mercury. [2] The sulphate of protoxide of iron decomposes the nitric acid, becoming sulphate of peroxide of iron, whilst a portion of undecomposed sulphate of protoxide entering into combination with the nitric oxide thus set at liberty, affords the characteristic colour, indicating that the salt is a nitrate. [3] Absence of such metallic impurities as would precipitate insoluble chlorides, and also of nitrate of the sub-oxide of mercury, which would precipitate subchloride of mercury or calomel.

Acid solution of nitrate of mercury acts as a powerful and energetic caustic; it is never given internally, nor should it be applied to extensive surfaces, as it is apt to be absorbed and cause salivation, besides giving rise to severe local pain. During its application the surrounding parts must be carefully protected. It has been employed in lupus, and to other aggravated chronic skin disease, to phagedenic, syphilitic, cancerous, and other spreading ulcerations, to ulcerations of the cervix uteri, to primary chancre, &c.

UNGUENTUM HYDRARGYRI NITRATIS.—OINTMENT OF NITRATE OF MERCURY. *Synonym:* UNGUENTUM CITRINUM, Ed.—*Take of mercury, by weight,* 4 *ounces; nitric acid,* 12 *fluid ounces; prepared lard,* 15 *ounces; olive oil,* 32 *fluid ounces. Dissolve the mercury in the nitric acid with the aid of a gentle heat; melt the lard in the oil, by a steam or water bath, in a porcelain vessel capable of holding six times the quantity; and, while the mixture is hot, add the solution of mercury, also hot, mixing them thoroughly. If the mixture do not froth up, increase the heat till this occurs. Keep it stirred until it is cold.*

Rationale.—Nitrate of mercury is formed, as in the previous case of the acid solution, and there is also present in the solution nitrous acid, peroxide of nitrogen, and nitric acid, by which, on the addition of the lard and oil, elaidine and an orange-red viscid oil are formed, the latter of which gives the characteristic colour to the ointment. When recently

and well prepared, citrine ointment is of soft consistency, of a golden or lemon-yellow colour, and has a characteristic nitrous odour; but it is prone to undergo change when it is exposed or long kept, becoming hard, brittle, and of a dark colour, due to the reduction of the metallic mercury; and this is more likely to happen if the quantity of nitric acid employed were not in large excess, or if the mixture were not made to froth up.

Ointment of nitrate of mercury, or citrine ointment, acts somewhat as an irritant when employed of officinal strength, and also as a stimulant and alterative. It may be diluted to any degree by the addition of prepared lard. It is used, sufficiently diluted, as an eye salve in chronic ophthalmia, in ophthalmia tarsi, and in granular conjunctivitis; it is also applied to a variety of chronic skin diseases, to indolent ulcers, &c., either alone or in combination with other remedies.

HYDRARGYRI SULPHURETUM (HgS)—Sulphuret of Mercury—Bisulphuret of Mercury—Red Sulphuret of Mercury—Crystallised Sulphuret of Mercury—Cinnabar—Minium—Vermilion—occurs native, and is the ore from which metallic mercury is chiefly extracted. It may also be prepared artificially by mixing six parts of mercury with one of sulphur, heating them together in an iron pot, and afterwards subliming them in a suitable vessel. It occurs either as a tasteless, inodorous, brilliant red powder, permanent in air, and insoluble in water and alcohol, or as a dark red coloured crystalline mass. Cinnabar acts as an alterative, but is rarely used internally; externally it is employed in quantities of from twenty to fifty or sixty grains, to fumigate ulcers and certain skin diseases; it has also been used to fumigate the throat, but the sulphurous acid generated at the time is exceedingly irritating, so that the suboxide of mercury is preferable. *Hydrargyri sulphuretum cum sulphure*—black sulphide of mercury, or Ethiop's mineral—is an insoluble black powder, which was formerly used as an alterative, but was found to be inert.

HYDRARGYRI SULPHAS (HgO,SO_3 or $HgSO_4$)—Sulphate (Persulphate or Bisulphate) of Mercury.

PREPARATION.—*Take of mercury, by weight,* 20 *ounces; sulphuric acid,* 12 *fluid ounces. Heat the mercury with the sulphuric acid in a porcelain vessel, stirring constantly, until the metal disappears, then continue the heat until a dry white salt remains.*

Rationale.—One atom of sulphuric acid is decomposed, forming sulphurous acid and oxide of mercury. The sulphurous acid being gaseous, escapes, and the oxide of mercury dissolves in the other atom of sulphuric acid, and forms one atom of persulphate of mercury, while two atoms of water are liberated by the reaction; thus—$Hg + 2H_2SO_4 = HgSO_4 + SO_2 + 2H_2O$. It is a white crystalline heavy powder, which, when placed in water, is decomposed into an acid sulphate, which is soluble, and a subsulphate, which is yellow and insoluble. It should be

entirely volatilised by heat. It is employed in the preparation of calomel and corrosive sublimate.

CHARACTERS.—*A white crystalline heavy powder, rendered yellow by affusion of water. Entirely volatilised by heat.*

HYDRARGYRI ACETAS—Acetate of Mercury—has been employed as a mercurial alterative, but its action is uncertain, having at one time a mild, and at another an energetic action, according to the mode of its preparation.

HYDRARGYRI BROMIDUM.—Two bromides of mercury have been employed in medicine, the one a sub-bromide, the other a bibromide. The *sub-bromide* ($HgBr$) occurs either in thin prismatic crystals, or as a white powder, insoluble in water and alcohol; it may be given in doses and for purposes similar to calomel. The bibromide ($HgBr_2$) occurs in brilliant white scales, if crystallised out of water, or in acicular crystals, if from alcohol; it is soluble in water, alcohol, and ether, and is given in doses and for purposes similar to corrosive sublimate.

HYDRARGYRI CYANIDUM ($HgCy_2$)—Cyanide, Bicyanide, or Cyanuret of Mercury—may be prepared by saturating the officinal hydrocyanic acid with oxide of mercury, or by the action of sulphuric acid and oxide of mercury upon ferrocyanide of potassium, &c. It occurs in white anhydrous prismatic crystals, which are permanent in air, are entirely soluble in water, and are sparingly soluble in alcohol. The salt is inodorous, but has a nauseous metallic taste. It is decomposed by heat, giving off cyanogen, and by hydrochloric acid it is converted into chloride of mercury, with the evolution of hydrocyanic acid. Cyanide of mercury is a powerful poison, but is said not to cause gastric pain. In doses, actions, and uses, it resembles corrosive sublimate.

HYDRARGYRI PHOSPHAS — A Subphosphate of Mercury ($2Hg_2O,HO,PO_5$ or Hg_2HPO_4), made by precipitating a subsalt of mercury by phosphate of soda, and occurring as a white crystalline insoluble powder, has been used in doses of one grain.

ARGENTUM ($Ag=108$—Silver)—Argent—Silber—the Luna or Diana of the alchemists, ☽—occurs native either massive, arborescent, or crystallised, but is seldom pure, also in the form of sulphide and chloride, and alloyed with other metals. It may be obtained from argentiferous sulphide of lead by roasting and cupellation, or by reducing other sulphides of silver by amalgamation. Silver is an exceedingly brilliant, white, malleable and ductile metal, having a specific gravity of 10·5. It melts at a bright red heat, said to be 1873°, and when in a state of fusion is extremely brilliant. It does not readily oxidise, but quickly tarnishes by the action of sulphuretted hydrogen.

ARGENTUM PURIFICATUM.—REFINED SILVER. Pure metallic silver.

TEST.—*If ammonia be added in excess to a solution of the metal in nitric acid, the resulting fluid exhibits neither colour nor turbidity.*[1]

[1] Indicating absence of gold, copper, and lead, with which it is sometimes mixed.

Argenti Nitras (AgO,NO_5 or $AgNO_3$). *Synonyms:* Nitrate of Silver—Lunar Caustic—Lapis Infernalis—Nitrate d'Argent—Silbersalpeter.

PREPARATION.—*Take of purified silver, 3 ounces; nitric acid, 2½ fluid ounces; distilled water, 5 fluid ounces. Add the nitric acid and the water to the silver in a flask, and apply a gentle heat till the metal is dissolved. Decant the clear liquor from any black powder which may be present, into a porcelain dish, evaporate, and set aside to crystallise; pour off the liquor, and again evaporate and crystallise. Let the crystals drain in a glass funnel, and dry them by exposure to the air, carefully avoiding the contact of all organic substances. To obtain the nitrate in rods, fuse the crystals in a capsule of platinum or thin porcelain, and pour the melted salt into proper moulds. Nitrate of silver must be preserved in bottles, carefully stoppered.*

Rationale.—Two atoms of nitric acid are decomposed to oxidise six equivalents of silver, nitric oxide being evolved, and six more atoms of nitric acid unite with the oxidised silver to form nitrate of silver, $3Ag_2 + 8HNO_3 = 6AgNO_3 + 2NO + 4H_2O$. Four atoms of water are set free during the reaction. The black powder referred to is gold, with which silver is frequently mixed. Organic substances tend to reduce the silver.

CHARACTERS.—*In colourless tabular crystals, the primary form of which is the right rhombic prism, or in white cylindrical rods, soluble in distilled water, and in rectified spirit; the solution gives with hydrochloric acid a curdy white precipitate,*[1] *which darkens by exposure to light,*[2] *and is soluble in solution of ammonia.*[3] *A small fragment heated on charcoal with the blow-pipe, first melts, and then deflagrates, leaving behind a dull white metallic coating.*[4]

PURITY TESTS.—*Ten grains dissolved in two fluid drachms of distilled water give with hydrochloric acid a precipitate, which, when washed and thoroughly dried, weighs 8·44 grains.*[5] *The filtrate when evaporated by a water bath leaves no residue.*[6]

[1] Of chloride of silver, which becomes darker[2] in consequence of giving off part of its chloride and becoming subchloride, and ultimately being reduced to metallic silver; [3] chloride of silver is dissolved by ammonia, but not by nitric acid. [4] The nitric acid and oxygen being driven off, and metallic silver remaining. [5] Indicating the presence of the proper quantity of silver and the absence of impurities. [6] Absence of fixed impurities, such as reduced silver, nitrates of soda, potash, copper, lead, zinc, &c. The filtrate should neither be discoloured by nor give any precipitate with sulphuretted hydrogen. Nitrate of silver has the same properties, whether it be crystallised or fused. It is inodorous, but has a bitter, nauseous, metallic taste. It is soluble in its own weight of cold water, in half its weight of boiling water, and in about four times its weight of boiling alcohol, from which it is deposited on cooling. It is permanent in air; when exposed to light and organic matters it is blackened, but light alone without organic matter does not discolour it. It enters into combination with animal tissues, forming insoluble compounds; and when it is applied to the skin or mucous membrane it produces a white pellicle, which gradually becomes darker, and at length

black, in consequence of the partial reduction of the silver. These stains are readily removed by *cyanide of potassium,* which, however, it is to be remembered, is a deadly poison.

Dose.—A quarter of a grain to two or three grains, made into pill with a vegetable extract. It is frequently made into pills with bread crumb, and it is doubtful whether the chloride of sodium contained in the bread interferes with the action of the remedy. Lotions and washes of nitrate of silver are made of various strengths, from one or two to twenty or more grains to the ounce of distilled water. Fused *lunar caustic* is used in the solid form externally.

Antidotes.—Administer common salt to precipitate the chloride, demulcent drinks, and facilitate vomiting; subsequent treatment according to circumstances.

Nitrate of silver in over-doses acts as a powerful corrosive poison; but there are very few cases of fatal poisoning by it on record. Medicinally, nitrate of silver acts as a sedative, alterative, astringent, antispasmodic, and tonic, when given internally; and as an alterative, astringent, stimulant, vesicant, and easily manageable mild caustic, when applied externally. When given internally for a considerable time, it is apt to cause a bluish, leaden, or indigo discoloration of the skin, which is permanent, and which—although it is said to be removable by the long-continued employment of iodide of potassium, bitartrate of potash, or dilute nitric acid—is generally believed to be indelible. Warning is said to be given of the approach of this discoloration by the appearance of a dark line along the edges of the gums; and it has been further stated that the discoloration does not supervene until the medicine has been continued upwards of three months. The cases for which it has been given internally are chiefly:—In affections of the alimentary canal, such as dyspepsia, nervous irritability of the stomach, ulcerations of the stomach, gastrodynia, pyrosis, obstinate chronic diarrhœa, acute and chronic dysentery and cholera, enemata containing the remedy being also employed in the cases in which its local applications by such means is available; in spasmodic diseases, such as epilepsy, chorea, chronic hooping-cough, and spasmodic asthma; in angina pectoris, in tubercular phthisis; in insanity depending upon nervous exhaustion and depression, or complicated with epilepsy; in nervous headaches; in jaundice; in mercurial palsy; in locomotor ataxia, &c. Externally, either in lotions of various strengths, or in the solid form, it has been used chiefly in affections of the eye, such as catarrhal, purulent, scrofulous, or gonorrhœal ophthalmia, ophthalmia tarsi, ulceration and opacity of the cornea, &c.; in affections of the mouth, throat, and larynx, such as relaxed, ulcerated, and malignant sore

throat, enlargement and ulceration of the tonsils, aphthous ulcerations, laryngitis, croup, diphtheria, ptyalism, &c.; in affections of the genito-urinary organs, either in the solid form or by injections, such as leucorrhœa, ulcerations of the os and cervix uteri, cancer of the uterus, chronic inflammation of the neck of the uterus, pruritus pudendi, as a topical application to the os uteri in amenorrhœa, in chronic inflammation of the bladder, in spermatorrhœa, in gonorrhœa, in stricture of the urethra, primary chancres, &c.; in external affections, such as a variety of skin diseases, the pustules of small-pox, erysipelas, and other inflamed surfaces, the bites of rabid and poisonous animals, dissection wounds, unhealthy ulcers and granulations, chapped nipples, warts, corns, a variety of tumours and enlarged glands, &c.; to arrest the bleeding of leech bites and minute vessels, &c.

Argenti Oxidum (AgO, or Ag_2O)—Oxide of Silver. PREPARATION.—*Take of nitrate of silver, in crystals,* $\frac{1}{2}$ *ounce; solution of lime,* $3\frac{1}{2}$ *pints; distilled water,* 10 *fluid ounces. Dissolve the nitrate of silver in four ounces of the distilled water, and, having poured the solution into a bottle containing the solution of lime, shake the mixture well, and set it aside to allow the deposit to settle. Draw off the supernatant liquid, collect the deposit on a filter, wash it with the remainder of the distilled water, and dry it at a heat not exceeding* 212°. *Keep it in a stoppered bottle.*

Rationale.—The lime abstracts the nitric acid to form soluble nitrate of lime, leaving the oxide of silver to be precipitated, $2AgNO_3 + CaH_2O_2 = Ca2NO_3 + Ag_2O + H_2O$.

CHARACTERS.—*An olive-brown powder, which at a low red-heat gives off oxygen, and is reduced to the metallic state. It dissolves completely in nitric acid without the evolution of any gas, forming a solution which has the characters of nitrate of silver.*

PURITY TESTS.—29 *grains heated to redness leave* 27 *grains of metallic silver.*

When recently prepared, this occurs as an olive-brown hydrated oxide, which gradually loses its water and becomes darker coloured as it is kept, being by long exposure to light decomposed into oxygen and suboxide, and finally reduced to metallic silver. It is an inodorous, tasteless powder, slightly soluble in water, the solution having an alkaline reaction, and entirely soluble in ammonia, forming Berthollet's fulminating silver, which is violently explosive. It is apt to contain carbonate of silver, especially when prepared with potash instead of lime; it then effervesces with nitric acid. The above test admits of no impurity.

Dose.—Half-a-grain to one or two grains, in pill; externally, as an ointment, sixty grains to the ounce of lard.

Oxide of silver acts in the manner of the nitrate, but is very much milder in its topical effects, and is said to be less liable to cause discoloration of the skin. It has been recommended in the same cases

as the nitrate, but is said to have a special action upon the uterus, and to be of use in menorrhagia, dysmenorrhœa, leucorrhœa, &c. In the form of ointment, it is applied, by means of a bougie, in gonorrhœa and gleet, and externally to venereal ulcers, &c. As a sedative, it is given in irritable dyspepsia, gastrodynia, &c.

ARGENTI CHLORIDUM ($AgCl$)—Chloride, Chloruret, Hydrochlorate, or Muriate of Silver—may be obtained by adding chloride of sodium to a solution of nitrate of silver; it is thrown down as a curdy white precipitate, which ultimately blackens; it is tasteless and inodorous, insoluble in water, alcohol, and nitric acid, but soluble in ammonia. The chloride has been proposed as a substitute for the nitrate of silver, in the belief that it would not produce discoloration of the skin, that it would be equally efficacious, and on the hypothesis that the nitrate is invariably changed into chloride in the stomach. It is a mild preparation, and has been employed in primary and secondary syphilitic affections, in scrofula, and in epilepsy, diarrhœa, dysentery, and other diseases in which the nitrate is recommended. *Dose,* half-a-grain to three grains.

ARGENTI IODIUM (AgI)—Iodide of Silver—may be prepared by adding iodide of potassium to a solution of nitrate of silver; it is thrown down as a pale yellow precipitate, insoluble in water and in nitric acid, and nearly insoluble in ammonia. Like the chloride, the iodide has been suggested as an efficient substitute for the nitrate of silver, unlikely to produce discoloration of the skin. *Dose,* half-a-grain to two grains.

AURUM ($Au = 196 \cdot 5$—Gold—Or—Gold—Rex Metallorum—the Sol of the alchemists, ☉—occurs as *native gold* in the metallic state, alloyed with silver and copper. It is found in the beds of rivers, in alluvial soil, and in the primitive rocks, and is generally obtained in small granular pieces, but occasionally in masses or nuggets. It is an exceedingly malleable and ductile metal, is unchanged by the atmosphere, is soluble in nitro-hydrochloric acid, and has a specific gravity of 19·2. There is no officinal preparation of gold, but on the Continent several preparations of gold are employed in medicine, the chief of which are:—

PULVIS AURI—Powder of Gold—may be obtained by rubbing gold-leaf with sulphate of potash, and dissolving out the potash; by mixing a solution of gold in nitro-hydrochloric acid with a solution of protosulphate of iron, when metallic gold in powder is precipitated (*aurum præcipitatum*); by rubbing gold-leaf with honey, or by filing gold (*auri limatura*). It occurs as a dark brown powder, and is employed as a tonic, alterative, and deobstruent, in syphilitic, scrofulous, chronic cutaneous, and glandular affections; it may be used as a substitute for mercury, and sometimes causes salivation. *Dose,* a quarter of a grain up to two or three grains, in pill, rubbed into the gums and tongue, or applied to a blistered surface.

AURI PEROXIDUM (Au_2O_3)—Sesquioxide, Peroxide, Teroxide of Gold, or Auric Acid—may be prepared by treating a solution of chloride

of gold with magnesia, washing the precipitate, and digesting it in nitric acid, which abstracts the magnesia and leaves the oxide of gold, which, when dried, is of a chestnut-brown colour, is insoluble in water, and is decomposed by light. It is somewhat irritating, but is employed in the same cases as powdered gold, in doses of one-tenth to one-quarter of a grain.

AURI CHLORIDUM ($AuCl_3$)—Terchloride, or Perchloride of Gold—may be obtained by evaporating the solution of gold in nitro-hydrochloric acid until chlorine begins to be evolved, then setting aside to crystallise. It occurs as a reddish powder, or in deep-red acicular or prismatic crystals; it is inodorous, but has a styptic nauseous taste; it is deliquescent, soluble in water, alcohol, and ether, and is readily decomposed by many metallic salts and organic compounds, and by light. It is exceedingly poisonous, and externally acts as an energetic caustic. It has been employed in syphilitic, scrofulous, and cutaneous affections, and externally as an application to lupoid and cancerous ulcerations, &c. It is apt to salivate, and in its poisonous properties somewhat resembles corrosive sublimate, the treatment also being the same. *Dose*, one-twentieth to one-twelfth of a grain, very cautiously.

SODII ET AURI CHLORIDUM ($NaClAuCl_3 2H_2O$)—Sodii Auro-terchloridum—Chloride of Sodium and Gold—may be prepared by mixing together in water about five parts of chloride of gold and one part of chloride of sodium, evaporating and crystallising. It forms deep yellow elongated four-sided prisms, which are soluble in water, but permanent in air. This is a cheaper, more permanent, and somewhat less energetic preparation than the pure chloride, and may be given for similar purposes, in doses of one-twelfth to one-quarter of a grain.

AURI IODIDUM (AuI_3)—Iodide of Gold—may be prepared by adding a solution of perchloride of gold to a solution of iodide of potassium until it ceases to precipitate, washing and drying the powder. It occurs as a dark-green or yellowish-green powder, insoluble in cold water, but readily soluble in hydriodic acid; when exposed to the air, the iodine gradually passes off, leaving metallic gold; and, moreover, it is decomposed by most organic substances. It is very poisonous. It may be used as an alterative, in doses of one-twentieth to one-tenth of a grain, as the other preparations of gold, but, from its instability, it is not to be depended upon. This, like the other preparations of gold, may be given in pill, or, mixed with a small quantity of some inert powder, may be applied by friction to the gums and tongue, or alone to a blistered surface. The preparations of gold are also used in the form of ointments externally.

PLATINUM ($Pt = 98 \cdot 5$, or 197) is found in the metallic state in small grains, alloyed with other metals, in alluvial soil and in streams, chiefly in Brazil, Peru, and in the Ural Mountains. It is of a silver-grey colour, very malleable, ductile, and tenacious, takes a good polish, and is remarkable for its infusibility, and for its resistance to chemical agents. Specific gravity 21·0. It is soluble in nitro-hydrochloric acid. It unites with oxygen to form two oxides, PtO and PtO_2. *Platini Perchloridum* ($PtCl_4$)—Perchloride of Platinum—may be obtained by dissolving pla-

tinum in nitro-hydrochloric acid and evaporating the solution, or by evaporating the test solution of the Pharmacopœia, until it has a deep brown colour, and yields red prismatic crystals, which consist of the hydrated perchloride of platinum; if the evaporation be continued, its combined water is driven off, and it forms a brown crystalline mass. The perchloride is deliquescent, and readily soluble in water and in alcohol; the aqueous solution gives yellow precipitates with potassium and with ammonium, constituting double chlorides, or platino-chlorides. The salt is exceedingly poisonous, but has been given in doses of one-tenth to one-quarter of a grain, as an alterative in syphilis and in the other diseases for which the preparations of gold have been recommended.

Sodii et Platini Chloridum ($NaCl,PtCl_2+6HO$, or $2NaClPtCl_4 6H_2O$) may be obtained by mixing solutions of perchloride of platinum and chloride of sodium, and evaporating. It occurs in yellow prismatic crystals, and has been employed as a cheaper and somewhat milder preparation, in the same cases as the perchloride of platinum and the analogous double chloride of sodium and gold. *Dose*, one-eighth, cautiously increased to half-a-grain.

PART III.—ORGANIC MATERIA MEDICA.

DIVISION I.—VEGETABLE KINGDOM.

A. *Phanerogameæ, Cotyledoneæ, or Flowering Plants.*

CLASS I.—DICOTYLEDONES, EXOGENÆ, OR ACRAMPHYBRIA.

SUB-CLASS I.—THALAMIFLORÆ.

RANUNCULACEÆ—The Crow-Foot Order—Buttercup Order—Herbs, rarely shrubs, inhabiting cool moist climates in Europe and North America, and also met with at considerable elevations within the tropics. The plants generally contain an acrid juice, and some of them a bitter principle. They act as rubefacients, caustics, sedatives, irritants, poisons, &c. Officinal plants, *Aconitum Napellus, Podophyllum peltatum.*

Aconitum—Aconite—Officinal plant: *Aconitum Napellus,* Linn.; *Polyandria Trigynia;* Monkshood, Wolfsbane, or Blue-rocket. Illustration of the plant, plate 6, *Woodv. Med. Bot.;* of the root, plate, page 449, vol. xv. *Pharm. Journ.* Officinal parts:—1. The fresh leaves and flowering tops; gathered, when about one-third of the flowers are expanded, from plants cultivated in Britain. 2. *Aconiti Radix;* the root, dried; imported from Germany, or cultivated in Britain, and collected in the winter or early spring before the leaves have appeared. 3. *Aconitia:* an alkaloid $C_{30}H_{47}NO_7$, obtained from aconite root. Officinal preparations: *Extractum Aconiti, Tinctura Aconiti, Linimentum Aconiti, Aconitia, Unguentum Aconitiæ.*

Botany.—Perennial herb. *Root,* tapering, with one or more lateral roots attached in summer. *Stem,* simple, erect, and leafy; two, three, or more feet in height. *Leaves,* palmated and divided to the petiole into five wedge-shaped segments, each of which is deeply cleft into long and slender parts; smooth and shining, dark green above, paler underneath. *Inflorescence,* a long spike-like raceme of dark blue or deep violet-coloured flowers; the calyx consists of five petaloid sepals, the upper one of which is helmet-shaped, and the lateral ones are hairy on the inner side; the helmet is semicircular; the petals are five, of which the two upper are carried upon long stalks into the helmet, and there terminate in shore horizontal sacks; the other petals are small and often abortive; the stamens are filiform, and the filaments are hairy; the ovaries are usually three, occasionally five. *Seeds,* numerous, angular, and wrinkled. *Flowering time,* May to July. *Habitat,* wooded hills in various countries of Europe; met with in this country, but not truly indigenous; cultivated as an ornamental plant in gardens.

CHARACTERS.—ACONITE FOLIA—Aconite leaves : *Leaves smooth, palmate, divided into five deeply-cut wedge-shaped segments ; exciting slowly, when chewed, a sensation of tingling.*[1] *Flowers numerous, irregular, deep blue, in dense racemes.*

ACONITI RADIX—Aconite root : *From one to three inches long, not thicker than the finger at the crown, tapering, blackish-brown, internally whitish. A minute portion, cautiously chewed, causes prolonged tingling and numbness.*[2]

[1] This property they possess from the first, and it is retained until the seeds appear, but is entirely lost when these are ripe. [2] The root acquires its greatest medicinal and poisonous activity in winter and early spring, when it is leafless, and, consequently, when the means of recognising it are less than at any other season. Several fatal cases of accidental poisoning have occurred in consequence of aconite root having been used as a garnish by mistake for horse-radish. In the *Pharmaceutical Journal*, as referred to by the Pharmacopœia, Professor Bently thus contrasts the roots :—

MONKSHOOD.	HORSE-RADISH.
Conical in form, and tapering perceptibly to a point.	Slightly conical at the crown, then cylindrical, or nearly so, and almost of the same thickness for many inches.
Coffee-coloured, or more or less brownish externally.	White, or with a yellow tinge.
Odour merely earthy.	Odour especially developed upon scraping, when it is very pungent and irritating.
Taste at first bitter, but afterwards producing a disagreeable tingling and numbness.	Bitter or sweet, according to circumstances, and very pungent.

Active Constituents.—Aconitia, an alkaloid met with in all parts of the plant, especially in the root ; *an acrid volatile principle,* not well ascertained, supposed by Pereira to be produced by the decomposition of aconitia ; *napellina ; aconitic acid ; aconella,* identical with narcotine.

EXTRACTUM ACONITI—EXTRACT OF ACONITE.—*Take of the fresh leaves and flowering tops of aconite,* 112 *pounds. Bruise in a stone mortar, and press out the juice ; heat it gradually to* 130°, *and separate the green colouring matter by a calico filter. Heat the strained liquor to* 200° *to coagulate the albumen, and again filter. Evaporate the filtrate by a water bath to the consistence of a thin syrup ; then add to it the green colouring matter previously separated, and, stirring the whole together assiduously, continue the evaporation at a temperature not exceeding* 140°, *until the extract is of a suitable consistence for forming pills.*

TINCTURA ACONITI—TINCTURE OF ACONITE.—*Take of aconite root, in coarse powder,* 2½ *ounces ; rectified spirit,* 1 *pint. Macerate the aconite root for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally ; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to*

pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.

LINIMENTUM ACONITI—LINIMENT OF ACONITE. — *Take of aconite root, in coarse powder,* 20 *ounces; camphor,* 1 *ounce; rectified spirit, a sufficiency. Moisten the aconite with some of the spirit, and macerate in a closed vessel for three days; then transfer to a percolator, and adding more spirit percolate slowly into a receiver containing the camphor, until the product measures one pint.*

Aconitia.—ACONITIA.—*An alkaloid,* $C_{30}H_{47}NO_7$, *obtained from aconite.*

PREPARATION.—*Take of aconite root, in coarse powder,* 14 *pounds; rectified spirit, distilled water, solution of ammonia, pure ether, diluted sulphuric acid, of each, a sufficiency. Pour upon the aconite root three gallons of the spirit, mix them well, and heat until ebullition commences, then cool and macerate for four days. Transfer the whole to a displacement apparatus, and percolate, adding more spirit, when requisite, until the root is exhausted. Distil off the greater part of the spirit from the tincture, and evaporate the remainder over a water bath until the whole of the alcohol has been dissipated. Mix the residual extract thoroughly with twice its weight of boiling distilled water, and when it has cooled to the temperature of the atmosphere, filter through paper. To the filtered liquid add solution of ammonia in slight excess, and heat them gently over a water bath. Separate the precipitate on a filter, and dry it. Reduce this to coarse powder, and macerate it in successive portions of the pure ether with frequent agitation. Decant the several products, mix, and distil off the ether until the extract is dry. Dissolve the dry extract in warm distilled water acidulated with the sulphuric acid; and, when the solution is cold, precipitate it by the cautious addition of solution of ammonia, diluted with four times its bulk of distilled water. Wash the precipitate on a filter with a small quantity of cold distilled water, and dry it by slight pressure between folds of filtering paper.*

Rationale.—Aconitia is believed to exist in aconite root, in combination with aconitic acid, in the form of *Aconitate of Aconitia.* This salt is dissolved out, in combination with resinous matters, in the first part of the process by the rectified spirit, which is recovered by distillation. The resinous matters are next removed by the filtration, being insoluble in the water, which retains the aconitate of aconitia. By the addition of ammonia the alkaloid, aconitia, is precipitated, aconitate of ammonia being formed in solution. The alkaloid is next removed by ether from any impurities which may exist in the precipitate, and is subsequently converted into the soluble sulphate of aconitia, by means of the sulphuric acid. Lastly, the sulphate is decomposed by ammonia, the alkaloid in a pure state being precipitated, whilst sulphate of ammonia is left in solution. The object of this process, which is a modification of that proposed by Dr Headlam, is to obtain the alkaloid free from aconitic acid, resinous, colouring, and other matters.

CHARACTERS AND TESTS.—*A white usually amorphous solid, soluble in* 150 *parts of cold, and* 50 *of hot water, and much more soluble in alcohol*

and in ether ; strongly alkaline to reddened litmus, neutralising acids, and precipitated from them by the caustic alkalies, but not by carbonate of ammonia or the bicarbonates of soda or potash. It melts with heat, and burns with a smoky flame, leaving no residue when burned with free access of air. When rubbed on the skin it causes a tingling sensation, followed by prolonged numbness. It is a very active poison.

Aconitia is inodorous, but has a bitter and pungent taste, a property, however, which it is somewhat hazardous to verify, seeing that *one-fiftieth of a grain of the pure alkoloid might prove fatal.* It is a virulent and highly dangerous poison, unfit for internal use, very expensive, and seldom pure.

UNGUENTUM ACONITIÆ—OINTMENT OF ACONITIA.—*Take of aconitia,* 8 *grains ; rectified spirit,* ½ *fluid drachm ; prepared lard,* 1 *ounce. Dissolve the aconitia in the spirit, add the lard, and mix thoroughly.*

Dose.—Aconite, in any form, must be very cautiously administered, and its effects must be closely watched. If applied externally to a broken surface, its poisonous effects may be produced. *The tincture* was intended to be of such a strength as to permit of its being administered in doses of from ten to twenty minims ; but as the greatly larger proportion of spirit employed in the present preparation exhausts the root much more thoroughly than when the tincture is prepared according to Fleming's process, it is found unsafe to give a dose higher than five minims, cautiously increasing it to ten minims. Less than three minims of Fleming's tincture have produced poisonous results. (*Note.—Fleming's Tincture* is five or six times stronger than the officinal tincture.) *The extract* may be given in doses of one or two grains, cautiously increased to four or more. *The liniment* is neither oily nor saponaceous, and, therefore, cannot be applied by friction when used alone. It may be applied by means of a camel's-hair pencil ; or it may be combined with soap liniment and be rubbed in. Each fluid ounce of the liniment represents an ounce of the root. It is, consequently, a very powerful poison, and should never be applied to surfaces with broken skin. *Aconitia*, the alkaloid, is not used internally ; it is the most powerful of poisons. *The ointment of aconitia* contains one grain of the alkaloid in sixty ; its activity depends upon the purity of the alkaloid ; if applied to a broken surface it might produce fatal consequences. It is of some importance to bear in mind, when prescribing this ointment, that aconitia costs about two shillings a grain. *Aconite root*, in powder, may be given in doses of two or three grains, cautiously increased ; the dried leaves may also be given in similar doses, but they are uncertain. *Succus aconiti* is sometimes prescribed ; and also an alcoholic extract made by evaporating the tincture, which is a very energetic preparation.

Antidotes.—There is no reliable antidote ; stimulating emetics, promptly followed by active stimulants, such as ammonia, brandy, or strong coffee ; tannin has been recommended with the view of forming an insoluble tannate of the alkaloid, but its value is uncertain. Animal charcoal suspended in water, may be freely given, followed by an emetic, with the view of entangling, and thereby delaying the absorption of the poison, the emetic removing it entirely.

Aconite is an energetic poison. All parts of the officinal plant are poisonous, owing to the presence of the alkaloid *aconitia*, which is the most deadly of the officinal preparations. This alkaloid is very much allied in its action to delphinia, veratria, and colchicina. The root is the most energetic part of the plant, and next in order, according to their activity, are the seeds, leaves, flowers, fruit, and stem. Even the smallest dose, such as cautiously chewing, without swallowing, a portion of one of the leaves or a slender shred of the root, or letting a drop or two of the tincture fall upon the tongue or lips, is followed by the physiological effects so characteristic of the plant, namely, a persistent numbness and burning taste, followed by a tingling of the parts touched, the sensation spreading to the throat if the dose be larger. According to Dr Fleming, aconite may prove fatal—1. By creating a powerfully sedative impression upon the nervous system; 2. By paralysing the muscles of respiration, and thereby giving rise to asphyxia; and, 3. By syncope. The following symptoms have been observed in cases of poisoning by aconite, all of which, however, are not necessarily present in every case, and their relative intensity will depend upon the manner in which the poison is taken, whether by one large dose, or by the repetition of smaller quantities. In a few minutes, or at latest within an hour, after taking the poison, there is a feeling of warmth in the stomach and nausea, which, according to circumstances, may proceed to severe irritation, accompanied by pain in the abdomen, and may be followed by vomiting and purging. The sensation of warmth beginning at the stomach is gradually distributed over the rest of the body, and is followed by numbness, a feeling of distension and tingling in the lips, tongue, cheeks, and throat, to relieve the parched condition of which the patient makes constant efforts at swallowing. The numbness and tingling gradually spread over the rest of the body, and are very distinct in the upper limbs and at the tips of the fingers. There is loss of muscular power, with giddiness and a sense of weariness and disinclination for exertion, usually culminating in utter prostration. The sensibility of the skin is greatly diminished. The heart's action is remarkably reduced, both in strength and frequency, the pulse being weak, and in some cases not exceeding forty beats per minute, until the last state arrives, when it usually rises into the small, weak, and frequent pulse of extreme debility. The respirations are also diminished in number and fulness, and are accomplished with more or less of effort. The pupil is at first contracted, but ultimately dilated, and

there is dimness and confusion of sight. Towards the end, in a fatal case, the vertigo and depression of the vital powers are increased; the countenance is pale and anxious; the surface of the body is cold and clammy; the pulse is rapid, irregular, and almost imperceptible; the breathing is performed by an irregular succession of sighs; there is frothing at the mouth; and death, when the case is thus continued for some hours, at length takes place by syncope, consciousness being commonly retained to the end. Occasionally the patient is completely paralysed; sometimes there is delirium, but the cerebral symptoms are rarely such as to deprive the patient entirely of consciousness; convulsions are seldom observed, though there are frequently tremblings or twitchings of the voluntary muscles; sight, hearing, and speech may be partially or quite lost. Death generally takes place between one and eight hours after taking the poison; and if life be sustained beyond the latter period, there is a probability of recovery, although the symptoms of depression will continue for several hours or longer. The quantity of any part of the aconite plant that will cause death depends chiefly upon the amount of aconitia present; a quantity of the root equal to what is ordinarily eaten of horse-radish at dinner has in many instances proved fatal; and in one case of fatal poisoning which occurred at Bristol, by the careless substitution of aconite root for horse-radish, Mr Herapath ascertained that the quantity taken was about thirty-five grains, equal, according to his calculation, to one-twentieth of a grain of pure aconitia. The effects of the medicinal preparations will also depend upon the amount of aconitia contained in them, and they should be administered with great caution. Fleming's preparations are generally considered to be dangerously strong, and should never be dispensed unless particularly specified in the prescription. *Medicinally*, aconite is used as an anodyne, sedative, antiphlogistic, and diuretic. Deobstruent virtues have been ascribed to it, but seemingly upon insufficient grounds. It was first brought into notice by Störck of Vienna, and by him and his followers recommended in a very numerous class of diseases. Dr Fleming of Birmingham also did much to raise the credit of aconite in this country. But he unfortunately adopted a tincture which was needlessly strong, and which consequently led to some accidents. It is, however, a drug of very great value when properly administered, and is daily becoming more popular with the profession.

It is employed, rubbed in locally, and at the same time administered internally, to relieve certain distressing local neuralgias, as

tic douloureux, pleurodynia, angina pectoris, &c. In such cases it is often of very great use. Its solutions in chloroform, or in a mixture of chloroform and alcohol, would appear, from the experiments of Dr Augustus Waller, to be much more readily absorbed by the skin, and consequently much more active as a local application than simple alcoholic solutions. Hence it is good to combine its liniment with that of chloroform for external use. Though it sometimes gives marvellously good results in neuralgia, yet, it must be confessed, that it more frequently fails. If, however, it is to succeed, it does so after two or three applications, and it seems to be more suitable for cases of pure neuralgia than when the pain is secondary to the inflammation set up by the irritation of a carious tooth, or by the pressure of a tumour, &c. It is also frequently useful as a *sedative* and *anodyne* application in lumbago, sciatica, in the painful joints of chronic gout and rheumatism, in cutaneous hyperæsthesia, in the treatment of sprains and contusions, &c. Care must be taken that aconite be not rubbed in where there is broken skin, lest poisonous symptoms result from its too rapid absorption. Internally it is administered as a sedative and anodyne, in certain painful affections of the heart, as in the pain resulting from constricted mitral, in angina pectoris, pericarditis, and nervous palpitations; to palliate the distressing agony resulting from internal aneurism; to calm the pain of cancer; to allay certain painful affections of the respiratory system, as in spasmodic asthma, emphysæma, bronchitis, convulsive cough. It is often very beneficial in headache, when that co-exists with a full bounding pulse and throbbing temples.

As an antiphlogistic, it is found useful in inflammatory diseases, such as cynanche tonsillaris, catarrhal croup, pleurisy, pneumonia, pericarditis (especially when accompanied with much throbbing pain), and in erysipelas.

Dr Sidney Ringer believes it can cut short and limit the intensity of most acute inflammations, if given sufficiently early, and in doses of half-a-minim every ten minutes or quarter of an hour for two hours, and afterwards in doses of one minim every hour.

Its diuretic properties are often beneficial in dropsies.

The administration of aconite in all cases requires careful watching to avoid inducing dangerous symptoms of depression.

ACONITUM FEROX, as its name implies, is a plant possessing the properties of aconite to a greater extent than the European varieties. It inhabits the Himalaya Mountains and Upper India, and is said to contain the alkaloid aconitia in large quantity. Mr T. Herapath and Dr

Headland, by nearly similar processes, obtained the following as the average results of several experimental analyses. From a pound of the fresh root of *Aconitum Napellus,* collected after the flowering of the plant, Mr Herapath obtained 8·58 grains of aconitia, whilst from a pound of the dried root, collected at the same period, he obtained 35·72 grains; whereas from a pound of the fresh root only 3·5 grains, and of the dried root only 12·13 grains were obtained, when it was collected before the flowering of the plant. Dr Headland obtained from a pound of one variety of the root of *Aconitum ferox,* which is "heavy," of a dense, horny texture, and contains a large quantity of "starch," and which he supposes to have been collected about the commencement of the Himalayan season, from 54 to 56 grains of aconitia; whilst from another variety, which "is light and friable, with a powdery or chalky appearance," he obtained from 88 to 92 grains of the alkaloid. *Aconitum ferox* may be used as a substitute for *Aconitum Napellus* when the preparations are made of equal strength; and what has been said of the medicinal properties of the latter may be generally accepted for the former also, which is largely employed in India, and from the root of which is obtained the Indian poison *Bikh, Bish,* or *Nabee.* There are many other varieties of aconite, and it is uncertain which of them was employed by Störck, or whether any of them agree in their characters with the Greek *ἀκόνιτον.* *Aconitum Napellus* is selected as the officinal plant because, besides possessing the peculiar medicinal properties to a considerable extent, it is also the most common and the most easily obtained of the species of aconite. Moreover, if, as was suggested by Dr Fleming, the acrimony of the various aconites can be accepted as the measure of their medicinal virtues, *A. Napellus* occupies a high position, for Dr Christison found the acrimony of *A. Napellus, Sinense, Tauricum, uncinatum* and *ferox,* to be intense; that of *A. Schleicheri* and *nasutum* to be feeble; that of *A. neomontanum* to be very feeble; whilst *A. paniculatum lasiostomum, Vulparia, variegatum, nitidum, Pyrenaïcum,* and *ochroleucum* were found to be entirely free from acrimony.

ACONITUM HETEROPHYLLUM—Atees—Butees—unlike the other varieties of aconite, possesses no poisonous properties. Under the name of *Atees,* the powdered rhizome is employed by the natives of India as a pure vegetable tonic and febrifuge. It has been recommended, on account of its febrifugal properties, as a substitute for quinine, in doses of twenty grains of the powder thrice a-day.

Podophyllum — Podophyllum — Officinal plant: *Podophyllum peltatum,* Linn.; *Polyandria Monogynia;* May Apple or American Mandrake. Illustration, plate 1819, *Bot. Mag.* Officinal parts:—1. The root dried; imported from North America. 2. *Podophylli Resina;* resin of podophyllum.

Botany.—Perennial herb. *Rhizome,* perennial, horizontal, creeping to an extent of several feet, presenting irregular tuberosities where the dootlets are given off. *Stem,* annual, simple, erect, ten to fifteen inches in height, terminating by division into two leaf-stalks, from the fork of which springs the solitary flower. *Leaves,* two in number, arranged richotomously at the summit of the stem, large, peltate, divided into five or seven wedge-shaped lobes, which are cleft or bifid at the apex.

Inflorescence, a large, solitary, somewhat fragrant, white flower, springing from between the leaves, with a recurved peduncle. *Fruit*, oval, about the size of an egg, crowned by the persistent peltate stigma, yellow when ripe, one-celled, containing about twelve ovate seeds in a thick, sweetish, acid pulp ; it is edible, and is known as the *Wild Lemon*. *Flowering time*, May. *Habitat*, damp and shady woods, and marshy ground generally, but occasionally in dry and exposed situations, in the United States.

Characters of the Root (Rhizome with rootlets).—*In pieces of variable length, about two lines thick, mostly wrinkled longitudinally, dark reddish-brown externally, whitish within, breaking with a short fracture ; accompanied with pale brown rootlets. Powder yellowish-grey, sweetish in odour, bitterish, subacrid, and nauseous in taste.*

It is generally met with in pieces from one to five or six inches in length, and about the size of a common goose-quill. The rootlets are slender (about the thickness of a knitting needle), and, when broken off, their position on the rhizome is marked by scars upon the under surfaces of the irregular tuberosities. The medicinal properties of the plant, which are readily imparted to alcohol, but only slightly to water, are confined to the rhizome and rootlets, though the leaves are said to possess narcotic properties.

Active Constituents.—Two resinous principles, one, probably the more active, soluble both in rectified spirit and in ether, the other soluble in rectified spirit, but not in ether ; the alkaloid *berberine ; saponin ;* gallic acid ; some fixed and volatile oil, &c.

Podophylli Resina—Resin of Podophyllum—Podophyllin.—A resin obtained from podophyllum by means of rectified spirit.

Preparation.—*Take of podophyllum root, in coarse powder*, 1 *pound ; rectified spirit*, 3 *pints, or a sufficiency ; distilled water, a sufficiency ; hydrochloric acid, a sufficiency. Exhaust the podophyllum with the spirit by percolation ; place the tincture in a still, and draw off the greater part of the spirit. Acidulate the water with one twenty-fourth of its bulk of hydrochloric acid, and slowly pour the liquid which remains after the distillation of the tincture into three times its volume of the acidulated water, constantly stirring. Allow the mixture to stand for twenty-four hours to deposit the resin. Wash the resin on a filter with distilled water, and dry it in a stove.*

Rationale.—The resinous principles are dissolved out by the rectified spirit ; the tincture thus prepared is reduced, by careful distillation, to the consistence of syrup, and when the residue is poured into the acidulated water the resin is deposited. The precipitation of the resin is rendered more prompt and complete by the addition of the acid, in which it is very insoluble ; but plain distilled water would also cause the deposition.

Characters.—*A pale greenish-brown amorphous powder, soluble in rectified spirit and in ammonia ; precipitated from the former solution by water, from the latter by acids.*

Purity Test.—*Almost entirely soluble in pure ether.*

The colour of commercial podophyllin varies from greenish-brown to a rich yellow, the latter colour being imparted to it by the yellow hydrochlorate of berberine; but when quite pure it is said to be white. The part which is insoluble in ether consists of the resin previously referred to as being soluble in rectified spirit, but insoluble in ether. It is doubtful whether this resin, which constitutes from one-fifth to one-quarter of the whole substance, possesses any of the purgative properties which characterise the other.

Dose.—The dose of the resin varies with the purity and activity of the preparation—from one-sixth to half-a-grain, as an alterative and cholagogue. Two or three grains act severely as a drastic cathartic. It may be combined with hyoscyamus to counteract its irritant effects. Its activity is said to be increased by combination with chloride of sodium, and also by long trituration with four to ten times its weight of sugar or sugar of milk. It may be given with other purgatives. Powder of podophyllum may be given in doses of from five to twenty grains; but its actions are uncertain, and it is seldom employed. Sour milk is recommended to arrest the violent action of an over-dose.

Podophyllum, but more commonly its resin, podophyllin, is employed as an alterative, cholagogue, or drastic cathartic, according to the dose. It somewhat resembles jalap in its action as a cathartic, producing copious liquid evacuations, which are at first of a bilious character. Podophyllin often causes griping and sometimes nausea, and must be tried cautiously until its mode of action in each case is ascertained; for sometimes small doses act powerfully, whilst in other instances comparatively large doses have but little effect. It has been largely employed as a substitute for mercurials, the good, but not the bad, properties of which it is said to possess. It is chiefly used in bilious constipation, in combination with other purgatives; in affections of the liver; in jaundice; and in all cases in which the liver is at fault. In small alterative doses it has been recommended in bronchitic and in pulmonary affections; as a brisk purgative, combined with calomel, it is given in a variety of inflammatory cases; in combination with acid tartrate of potash, in dropsies; and as a substitute for mercurials in syphilitic affections, &c. The pure resin acts externally as an escharotic; and a tincture of the resin has been used as a counter-irritant.

HELLEBORUS NIGER—Black Hellebore—Christmas Rose—the Melampodium of the Ancients; *Polyandria Polygynia.* Herbaceous, with a perennial, black, rough, knotty rhizome, from which descend numerous root fibres; leaves, radical, large, stiff, deep green, pedatisect; scape, erect, leafless, one or two flowered; flowers, large, white, subsequently with a pinkish tinge. Flowering time, December to March, whence its name of Christmas rose. *Habitat,* the lower mountains of Central Europe; cultivated in our gardens as an ornamental plant. The

rhizome and root were formerly officinal; imported from Hamburg and Marseilles. Hellebore is rarely used now. In over-doses it acts as an acro-narcotic poison, and in medicinal doses as a griping drastic cathartic, and a diuretic. It was formerly given in apoplexy, insanity, hypochondriasis, melancholia, dropsies, as a quack remedy for worms, &c. It was also formerly used as an emmenagogue, and as an anthelmintic. The fresh root applied externally causes vesication. Ten to twenty grains of the freshly-powdered rhizome and root act as a drastic purgative: an infusion made with two drachms to a pint of boiling water may be given in one-ounce doses. A tincture and an alcoholic extract were also used. *Helleborus fœtidus* and *H. viridis* are fully as active as black hellebore, and possess similar poisonous and medicinal properties.

DELPHINUM STAPHISAGRIA—Stavesacre—*Polyandria Polygynia.* Biennial, with a tall, herbaceous, erect, simple, downy stem; leaves large, palmately cleft, veined and downy; inflorescence, a lax raceme of bluish or purplish flowers; seeds numerous, irregularly triangular, brownish externally, with a bitter, acrid, disagreeable taste. Flowering time, April to August. *Habitat*, Southern Europe, Asia Minor. The seeds were formerly officinal. Their activity depends upon the presence of the alkaloid *delphinia,* constituted, according to Courbe, of $C_{27}H_{38}N_2O_2$. This occurs as a pale yellow or white powder, with a persistent burning, acrid taste, and is soluble in alcohol and ether. Stavesacre is now seldom employed internally. In overdoses it acts as an acro-narcotic poison; in full medicinal doses as a violent emetic and cathartic, and in smaller doses, administered either by the mouth or by the rectum, as an anthelmintic. It is chiefly used externally for the destruction of pediculi (hence a common name of the plant, *Louse-Wort*), either in the form of a lotion made by infusing the bruised seeds in vinegar, or as a spiritous solution, or an ointment of delphinia. It is also recommended as an external application in scabies. Delphinia has been employed as an external application in neuralgia, tic douloureux, rheumatism, paralysis, &c.; it produces redness and a burning sensation in the skin. Dose of the powdered seeds, three to ten grains; of delphinia, a quarter to half-a-grain; but they are seldom given. As an ointment, thirty grains of delphinia, sixty minims of olive oil, and one ounce of lard.

ACTÆA RACEMOSA—*Cimicifuga racemosa*—Cohosh—Black Snake Root.—Root perennial; when fresh is large, fleshy, thick, twisted, rough, brownish-black externally, whitish within, has an acrid and astringent taste, and a peculiar, disagreeable odour; stem herbaceous, three to eight feet in height, and slightly furrowed; leaves large, somewhat resembling those of *Aconitum Napellus;* flowers small, white, in a long terminal raceme; fruit, an ovate capsule, containing many seeds. *Habitat,* rocky and shady woods in United States. The root is the medicinal part; it yields its virtues to alcohol, and, to a less extent, to water; its active ingredient, called *cimicifugin,* is a dark brown, impure, resinoid substance, obtained by evaporating a strong tincture. Cimicifuga, or *Actæa racemosa,* has been classed with arterial and nervous sedatives, with expectorants, tonics, special stimulants of the uterus, &c. In over-doses it causes vertigo, impaired vision, nausea, and vomiting.

Medicinally, both the preparations of the root, and the active principle cimicifugin, have been recommended in chorea, in epilepsy, in acute and chronic rheumatism, in sciatica, in lumbago, in uterine affections, in protracted labour as a substitute for ergot, in bronchitic and pulmonary affections, &c. The powdered root may be given in doses of ten to thirty grains; but a more eligible form is a tincture made of the strength of four ounces of the root to a pint of proof spirit, and given in doses of one to two fluid drachms. A decoction and extract are also used. *Coptis trifolia, gold thread,* so called from its bright yellow, slender, creeping roots, is a small evergreen plant, inhabiting the northern regions of Asia and America. All parts of the plant are bitter, and the root, which is especially so, has been used as a simple non-astringent, bitter tonic, in the form of tincture or infusion. *Coptis teeta,* under the name of *Mishmee teeta, Mishmee Bitter,* or *Mahmira,* is also used as a tonic. *Xanthoriza apiifolia, American yellow root,* is a small shrub, inhabiting the southern part of the United States. The root and bark of the stem are bitter. Berberine has been found in the root. The powdered root, an infusion, and tincture, are used as a simple bitter tonic. *Hydrastis Canadensis, yellow root, orange root, golden seal, yellow Puccoon,* as it is variously called, has a perennial rhizome of a bright yellow colour, whence its familiar names. It inhabits the northern parts of North America, and its rhizome and rootlets have been, from a remote period, employed as medicine and as a dye by the Indians of that region. It contains berberine, an alkaloid termed *hydrastine, hydrastia,* or *hydrastina,* and a resinoid termed *hydrastin.* It has been recommended as a tonic in intermittents, and in convalescence from exhausting diseases; it is said, also, to act as a cholagogue and deobstruent, and to act especially upon mucous membranes. The seeds of *Nigella sativa* were formerly used as a condiment instead of pepper. The leaves of *Clematis erecta* and *Flammula* have been employed as rubefacients and vesicants. The roots of *Ranunculus Ficaria,* on account of the starch which they contain, have been used as food.

MAGNOLIACEÆ—The Magnolia Order.—Trees or shrubs, having luxuriant foliage and fragrant flowers. They inhabit chiefly North America; but are met with also in China, Japan, West Indies, Australia, New Zealand, &c. They characterize one of Schouw's phyto-geographic regions—the region of Magnolias. The order is divided into two suborders: 1. *Magnolieæ;* 2. *Wintereæ.* The medicinal properties of the plants are chiefly bitter, tonic, and aromatic. Officinal plant: *Illicium anisatum.*

Illicium anisatum—Star Anise.—So named from the stellate form of its fruit, and from its anise-like flavour. *Polyandria Octogynia.* Illustration, plate 369, *Nees Plant. Med.* Officinal part: The oil distilled from the fruit in China. An evergreen shrub, about eight feet in height. Its fruit consists of from five to ten carpels, arranged in a stellate form, and, when ripe, brownish, hard, and woody. Each carpel contains one compressed, reddish-brown seed, from which the fragrant volatile oil is obtained by distillation. *Habitat,* China and Japan. A large proportion of the oil of aniseed (also known as *Oleum badianæ*) of commerce is supplied from this source, and is imported

from China and Singapore. It is said to be superior to that obtained from *Pimpinella anisum,* from which it is distinguishable by being fluid at 35°.

DRIMYS WINTERI—*Drimys aromatica — Wintera aromatica*— Winter's Bark Tree—receives its name from Captain Winter, R.N., who brought an account of it from the Straits of Magellan in 1579. It inhabits also Chili, Peru, and New Grenada, and is one of the largest forest trees of Tierra del Fuego. It is a handsome evergreen, often attaining a height of fifty feet. The bark (*Cortex Winteri*) is of a dark cinnamon colour, and is spotted. It is brought home in pieces of about a foot to eighteen inches in length, an inch or two in diameter, a quarter of an inch thick, and either quilled or rolled. It is sometimes replaced by canella bark, which is hence also called *False Winter's Bark.* The following characters will serve to distinguish them :—Winter's bark is darker in colour, and contains tannin and sulphate of potash, both of which are given up to an infusion; therefore the infusion of Winter's bark is turned black by the salts of iron, and gives a precipitate with chloride of barium, neither of which changes is observed with infusion of canella. The bark has an aromatic odour, and a warm spicy taste: it has been used as a carminative, stimulant, and tonic, and formerly as an antiscorbutic, but is now rarely employed. *Drimys granatensis,* which possesses properties similar to, and is possibly a variety of, *D. Winteri,* affords the aromatic bark, termed *Casca d'Anta* in Brazil. *Magnolia glauca, swamp sassafras,* or *beaver tree,* supplies a tonic aromatic bark, which is sometimes employed as a substitute for cinchona. The bark of *Liriodendron tulipifera, tulip tree,* is also bitter and tonic. The fruit of *Tasmania aromatica* has been employed in New Holland as a substitute for pepper.

MENISPERMACEÆ—Moon-Seed Order.—Trailing or climbing shrubs, inhabiting the tropical forests of Asia and America, where they climb among the trees to a considerable height. The plants possess narcotic and bitter properties; some are poisonous, and a few mucilaginous. Officinal Plants: *Cissampelos Pareira, and Cocculus palmatus, Anamirta Cocculus* (*Menispermum Cocculus*), formerly officinal, is now excluded from the pharmacopœia.

Pareira — Pareira. — Officinal plant: *Cissampelos Pareira,* Linn; *Diœcia Monadelphia; Pareira brava,* Wild Vine, or Velvet Leaf. Illustration, plate 82, *Woodv. Med. Bot.* Officinal part: The dried root from Brazil. Officinal preparations: *Decoctum Pareiræ, Extractum Pareiræ, Extractum Pareiræ Liquidum.*

Botany.—A climbing shrub. *Root,* woody and branching. *Stem,* round, smooth, downy, and twining. *Leaves,* roundish, smooth above, pubescent on their under surface. *Inflorescence,* racemose; flowers diœcious, small and yellow. *Fruit,* a scarlet, hispid, obliquely reniform drupe or berry, wrinkled round its margin. *Seed,* solitary, uncinate. *Habitat,* West Indies, Brazil.

CHARACTERS OF THE ROOT. — *Cylindrical oval or compressed pieces, entire or split longitudinally, half-an-inch to four inches in diameter, and*

four inches to four feet in length. Bark greyish-brown, longitudinally wrinkled, crossed transversely by annular elevations; interior woody, yellowish-grey, porous, with well-marked, often incomplete concentric rings and medullary rays. Taste at first sweetish and aromatic, afterwards intensely bitter.

Pieces of the stem are sometimes mixed with the root, and may be detected by the absence of many of the above characters. The stem possesses properties similar to those of the root, but is less efficacious: the root is inodorous.

Active Constituents.—*Cissampelin* or *Pelosin* ($C_{18}H_{21}NO_3$), an alkaloid, soluble in alcohol and ether, insoluble in water, but swells up and combines with it. The dried root yields from four to five per cent. of it. The root also contains a yellow bitter principle, starch, nitrate of potash, &c.

DECOCTUM PAREIRÆ — DECOCTION OF PAREIRA. — *Take of Pareira, sliced,* 1½ *ounce; distilled water,* 1 *pint. Boil for fifteen minutes in a covered vessel, then strain and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.*

EXTRACTUM PAREIRÆ — EXTRACT OF PAREIRA. — *Take of pareira root, in coarse powder,* 1 *pound; boiling distilled water,* 1 *gallon, or a sufficiency. Digest the pareira with a pint of the water for twenty-four hours, then pack in a percolator, and adding more of the water, allow the liquor slowly to pass until a gallon has been collected, or the pareira is exhausted. Evaporate the liquor by a water-bath until the extract has acquired a suitable consistence for forming pills.*

EXTRACTUM PAREIRÆ LIQUIDUM—LIQUID EXTRACT OF PAREIRA.—*Take of Pareira, in coarse powder,* 1 *pound; boiling distilled water,* 1 *gallon, or a sufficiency; rectified spirit,* 3 *fluid ounces. Digest the Pareira with a pint of the water for twenty-four hours, then pack in a percolator, and adding more of the water, allow the liquor slowly to pass, until a gallon has been collected or the Pareira is exhausted. Evaporate the liquor by a water-bath to thirteen fluid ounces, and, when it is cold, add the spirit, and filter through paper.*

Dose.—Of the decoction, one, two, or more fluid ounces; of the extract, ten to twenty grains; of the fluid extract, half a fluid drachm to two fluid drachms; or the liquid extract and decoction may be combined in smaller quantities. The powdered root may be given in doses of thirty to sixty grains, but it is ineligible.

Pareira acts as a mild tonic, and somewhat as a diuretic in moderate doses, and in larger quantity as an aperient. It acts specifically upon the genito-urinary tract of mucous membrane, operating as a gentle astringent and sedative, and modifying the quality of the urine. It is given in chronic cystitis, and in all cases of chronic mucous and purulent discharges from the genito-urinary passages, as in catarrhal affections of the bladder, gonorrhœa, leucorrhœa, &c.; but it is chiefly valuable in correcting the mucous discharge of

chronic cystitis, and for this purpose may be combined with anodynes, with alkalies, or with the mineral acids, as circumstances require. Formerly, it was held in repute as a lithontriptic, but its efficacy as such has not been established.

CALUMBÆ RADIX—CALUMBA ROOT.—The root, cut transversely and dried, of Jateorrhiza Columba, *Miers*, and J. Miersii, *Oliv.* MS. *in Flor. Trop. Afric.* ined. Cocculus palmatus, *non D.C.; Steph. and Church. Med. Bot.* plate 160. From the forests of Eastern Africa, between Ibo and the Zambezi. Officinal preparations: *Extractum Calumbæ, Infusum Calumbæ, Tinctura Calumbæ.* It is also a constituent of the Mistura Ferri Aromatica.

Botany.—A climbing plant. *Root,* perennial, composed of a number of fasciculated, fusiform, fleshy tubers, covered with a thin brown epidermis, marked with transverse warts; internally, deep yellow, inodorous, very bitter, and filled with longitudinal fibres. *Stem,* annual, herbaceous, twining, simple in the male plant, branched in the female, round, green, hairy below, and about the size of the little finger. *Leaves,* alternate, nearly orbicular, deeply cordate, five to seven-lobed, lobes entire, waivy, hairy, dark green above, paler underneath. *Inflorescence,* racemose; flowers diœcious, small and green. *Fruit,* a drupe or berry, about the size of a hazel nut, thickly covered with long, spreading hairs, which, at their extremities, are tipped with a black gland. *Seeds,* subreniform, five or six. *Habitat,* the thick forests covering the shores between Ibo and Mozambique, on the east coast of Africa, and inland for about fifteen or twenty miles. According to Miers, the officinal calumba root is derived from *Jateorrhiza calumba,* Miers; the *Menispermum calumba,* Roxb.; and the *Cocculus palmatus,* Wallich; and not from the *Cocculus palmatus,* D.C.

CHARACTERS OF THE ROOT.—*Slices flat, circular, or oval, about two inches in diameter, and from two to four lines thick, softer and thinner towards the centre, greyish-yellow, bitter. A decoction, when cold, is blackened by the solution of iodine.*

The root is met with in slices of from half-an-inch to three inches in diameter, and from two or three lines to half-an-inch in thickness. The slices consist of an outer cortical portion, two or three lines in thickness, covered with a smooth or somewhat rugous, yellowish-grey or brownish epidermis; next to this is a very thin, dark-coloured layer; and internally is the ligneous portion, which is of a yellowish-grey colour, spongy, thinner towards the centre from shrinking in the drying, and marked with concentric rings and radiating lines. The taste is bitter, aromatic, and mucilaginous; the odour slightly aromatic. The blackening of the cold decoction by iodine is due to the presence of starch. The root is brittle, and therefore easily reduced to powder, which is slightly greenish, becomes darker by keeping, and readily decomposes by absorbing moisture. Sometimes the pieces are perforated; this is due to the removal of the starch by insects.

The plant is not cultivated, the natural supply being adequate to the demand. The natives dig up the roots in the dry season (March), when they are not otherwise occupied with agriculture. The offsets (or tubers)

from the base of sufficiently-grown roots alone are taken, and these are soon afterwards cut into slices, strung on cords, and hung up to dry in the shade. When, on exposure to the sun, it breaks short, it is deemed fit for commerce; but when it is soft or black, it is of a bad quality. The root of *Frasera Walteri,* American or False Calumba, has been substituted for the true Calumba root; it contains tannin, but comparatively little starch, and may be known by its infusion becoming dark green on the addition of perchloride of iron. Bryony root, which has also been substituted for it, may be recognised by its permanent bitter and acrid taste. The wood of *Coscinium* (*Menispermum*) *fenestratum*—which, in common with its bark, possesses stomachic properties, and contains much berberine—has been brought from Ceylon and sold in this country as true Calumba root.

Active Constituents.—*Calumbin,* an inodorous, very bitter, crystallizable, neutral principle; *Berberine, Calumbic acid,* a trace of volatile oil, &c., the root contains also about one-third of its weight of starch. It contains no tannin.

EXTRACTUM CALUMBÆ—Extract of Calumba.—*Take of Calumba root, cut small,* 1 *pound; distilled water,* 4 *pints. Macerate the calumba with two pints of the water for twelve hours, strain and press. Macerate again with the same quantity of water, strain and press as before. Mix and filter the liquors, and evaporate them by the heat of a water-bath until the extract is of a suitable consistence for forming pills.*

INFUSUM CALUMBÆ—Infusion of Calumba.—*Take of Calumba root, cut small,* ½ *ounce; cold distilled water,* 10 *fluid ounces. Macerate in a covered vessel for one hour, and strain.*

TINCTURA CALUMBÆ—Tincture of Calumba.—*Take of Calumba root, cut small,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the Calumba for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of the spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of the extract, two or three to five or ten grains. Of the infusion, which should be recently made, as it keeps badly, one to two or three fluid ounces; it is made with *cold* water, to prevent the abstraction of starch; it may be prescribed with the preparations of iron, or with the alkalies, and their carbonates, as it is not altered by any of them. Of the tincture, half-a-fluid drachm to two fluid drachms. The powdered root may be given in doses of ten to thirty grains.

Calumba acts as a mild bitter tonic and stomachic, neither stimulant nor astringent, but somewhat demulcent from the starch and mucilage which it contains. It allays irritability of the stomach, improves the appetite, and is frequently retained when other tonics would be rejected. It is given in cases of general debility, with

feeble appetite, imperfect digestion, acidity, and flatulence; in convalescence from exhausting diseases; to arrest the vomiting of pregnancy, of a bilious attack, that which arises from renal calculi, or which obstinately persists after the administration of an emetic, and in other forms of vomiting of a non-inflammatory origin. It is given also as a mild tonic in certain cases of diarrhœa, dysentery, low fever, &c.

Cocculus—*Cocculus Indicus,* formerly officinal, is obtained from *Anamirta Cocculus* (*Wight and Arnott, Flor. Penins. Ind. Orient.*) Illustration, *Wallich, Asiat. Res.*, vol. xiii. plates 15 and 16 (*Menispermum Cocculus*). Officinal part: The fruit dried, produced in Malabar and the Eastern Archipelago. The Anamirta Cocculus is a strong climbing shrub, with a corky, ash-coloured, deeply-cracked bark, with large, roundish or cordate, leathery leaves. *Inflorescence*, lateral compound racemes; flowers diœcious. *Fruit,* drupaceous, one-celled and one-seeded. When dried, they are somewhat larger than a full-sized pea, slightly ovate, blackish-brown, wrinkled, containing a yellowish, oily, bitter reniform seed, enclosed in a two-valved shell.

An ointment, formed by beating up eight grains of the bruised seeds with an ounce of lard, was formerly officinal.

The seeds contain *Picrotoxin,* a crystalline principle, usually acicular, white, intensely bitter; soluble in 150 parts of water at 57°, in 25 parts at 212°, in three parts of alcohol, and in about two of ether. *Menispermia* and *Paramenispermia* have been obtained from the shell, which does not contain picrotoxin.

Cocculus Indicus acts in over-doses as an acro-narcotic poison, causing a disagreeable taste, a burning sensation in the mouth and gullet, followed by nausea, vomiting, griping pains, giddiness and staggering, resembling intoxication, tetanic convulsions, coma, and death. Its action in smaller doses has not been well ascertained. It is employed to capture fish and game, which it stupefies and destroys, and is also dishonestly added to beer to render it more bitter and intoxicating. The fish and game obtained by means of it are often eaten with impunity; but they are apt to contract the dangerous properties of the poison, especially if they die slowly, and they might transmit the fatal influence when eaten. Cocculus Indicus is not employed internally as a medicine. Externally, in the form of ointment, or as an ointment of picrotoxin, ten grains to the ounce, it is used to destroy pediculi. It has also been used in scabies, in porrigo, and other chronic cutaneous diseases. If applied to a broken surface, its poisonous effects would be produced by absorption. As a poison it has no known antidote: acetic acid has been given with a measure of success. The stomach should be emptied, and the symptoms combated as they arise.

BERBERIDACEÆ—The Barberry Order.—Shrubs or herbaceous perennial plants, inhabiting the temperate parts of the northern and southern hemispheres. *Berberis vulgaris,* the common barberry, has an acid and astrigent fruit, which is used as a preserve; the bark and stem are astringent, and contain the principle berberine, so named from

its primary recognition in this plant. Berberine is a yellow crystalline alkaloidal base, met with in the plants of several natural orders. It has been obtained from the bark and stem of the common barberry, from Calumba root, in combination with calumbic acid, from the calumba wood of Ceylon, from the Berberine or Yellow-dye tree of Soudan (*Cœlocline polycarpa*), from the root of the May-apple (*Podophyllum peltatum*), from the root of *Hydrastis canadensis*, &c. It occurs in yellowish stellated prisms, with twelve atoms of water, and has probably the constitution $C_{10}H_{17}NO_4$; it has a strongly bitter taste, is inodorous, and is neutral to test paper; it is readily soluble in boiling water and in alcohol, but is insoluble in ether. When heated to 212°, it loses ten atoms of its water, and becomes red, but reassumes its yellow colour on cooling. Strong sulphuric acid gives an olive-green solution; strong nitric acid gives a red solution, with the evolution of nitrous acid fumes; ammonia gives a yellowish-brown colour with it. By union with the mineral acids, it forms more or less soluble salts; *Hydrochlorate of berberine* is met with in bright yellow crystals with five atoms of water; it has been employed (under the name of *Hydrastin*) as a tonic, in doses of three to five grains. Berberine has been given as a tonic in doses of three to five grains; in larger doses it is said to be laxative. Berberine must not be mistaken, from the similarity of its name, for the Berberia or Bebeerine, derived from *Nectandra Rodiœi*, or Greenheart tree. Dr Royle has determined that the astringent *Lycium* of Dioscorides was obtained from a species of Berberis; and in the present day, the natives of India prepare from *Berberis lycium* and *Berberis aristata* a watery extract, called Rusot or Ruswut, which is highly esteemed as a febrifuge.

SARRACENIACEÆ—The Sarracenia, Water Pitcher, or Side-Saddle Flower Order.—Perennial herbs growing in bogs in North America. *Sarracenia purpurea*, the Purple Pitcher Plant, Indian Pitcher Plant, or Indian Cup; *Polyandria Monogynia*. The root of this plant was introduced as a remedy in small-pox, in consequence of its having been long esteemed by the North American Indians, both as a prophylactic and curative agent in that disease; but, after a fair trial in this country and in North America, its reputation was not sustained.

PAPAVERACEÆ—The Poppy Order.—Herbs, with a milky or coloured juice, chiefly inhabitants of Europe. The medicinal properties of this order are principally narcotic; some of the plants yield an acrid juice, and some are purgative. Officinal plants: *Papaver Rhœas, Papaver somniferum.*

Rhœados Petala—Red Poppy petals.—Officinal plant: *Papaver Rhœas*, Linn.; *Polyandria Monogynia;* Corn Poppy, Red Poppy. Illustration, plate 186, *Woodv. Med. Bot.* Officinal part: The fresh petals; from indigenous plants. Officinal preparation: *Syrupus Rhœados.*

Botany.—Annual. *Root*, fibrous. *Stem*, many-flowered, bristly, with spreading hairs, one to two feet high. *Leaves*, pinnatifid, incised. *Petals*, large, undulated, bright scarlet, dark purple or nearly black at the base. *Capsule*, smooth, obovate, rounded at the base. *Flowering time*, June and July. *Habitat*, corn fields and road sides throughout Europe.

CHARACTERS OF THE PETALS.—*Of a scarlet colour, and heavy poppy odour.*

The petals are collected immediately after their expansion, when they are rich in colour and have a poppy odour, both of which characters they lose by keeping. They contain about forty per cent. of red colouring matter, which they impart to water ; they also contain probably a trace of morphia. They possess feeble narcotic properties, but not to such an extent as to render them medicinal, their chief use being to afford a colouring ingredient to be added to other medicines, as in the following officinal form :—

SYRUPUS RHŒADOS—SYRUP OF RED POPPY.—*Take of fresh red poppy petals,* 13 *ounces ; refined sugar,* 2¼ *pounds ; distilled water,* 1 *pint, or a sufficiency ; rectified spirit,* 2½ *fluid ounces. Add the petals gradually to the water heated in a water-bath, frequently stirring, and afterwards, the vessel being removed, infuse for twelve hours. Then press out the liquor, strain, add the sugar, and dissolve by means of heat. When nearly cold, add the spirit, and as much distilled water as may be necessary to make up for loss in the process, so that the product shall weigh three pounds ten ounces. It should have the specific gravity* 1·330.

Papaveris Capsulæ—Poppy Capsules.—Officinal Plant : *Papaver somniferum,* Linn. ; *Polyandria Monogynia* ; White Poppy, Opium Poppy, Garden Poppy. Illustration, plate 185, *Woodv. Med. Bot.* Officinal part : The nearly ripe capsules, dried and deprived of the seeds ; cultivated in Britain. Officinal preparations : *Extractum Papaveris, Decoctum Papaveris, Syrupus Papaveris.*

Botany.—Annual. *Root,* white and tapering. *Stem,* two to four feet high, erect, round, smooth, glaucous, branching, with a few rigid spreading hairs at the upper part. *Leaves,* amplexicaul, alternate, large, oblong, waved at the margins, lobed, glaucous. *Flowers,* large, terminal, with four large petals of a bluish-white colour, having a broad purple or violet spot at the base. *Capsule,* large, smooth, oval or nearly globose, with parietal placentæ equal to the number of stigmas. *Seeds,* numerous, covering the placentæ, reniform, white or brownish, oily, not narcotic. *Flowering time,* June and July, the capsules ripening about two months afterwards. *Habitat,* probably Persia ; but common in gardens, fields, and waste places throughout Europe, apparently wild, but probably having escaped from gardens ; cultivated in Asia Minor, India, and Egypt, for the preparation of opium ; that which is cultivated in Britain being valuable only for the capsule, and the oil obtained from the seeds.

CHARACTERS OF THE POPPY CAPSULES.—*Globular, two or three inches in diameter, crowned by a sessile stellate stigma.*

Poppy capsules are collected when nearly but not quite ripe, when they possess their narcotic properties to the fullest extent ; they lose their opiate odour by keeping, and vary in activity according to age and the period at which they were collected. Their seeds, called *maw* seeds, yield a fixed bland yellowish oil *(poppy-seed oil)* without narcotic properties ; they contain to a slight extent the active ingredients of opium, especially if gathered unripe. In India, the capsules are collected after the opium has been obtained from them ; the oil extracted from the seeds is used by the natives for burning in lamps and for certain culinary purposes ; the

entire seed is made into a comfit, resembling caraway comfits ; the dried cake which remains after the extraction of the oil is made into a kind of coarse unleavened bread, which is either eaten by the very poor, or given to cattle, or used for poultices ; and from the entire capsules, deprived of their seeds, decoctions are made, which are used both internally and externally.

EXTRACTUM PAPAVERIS—EXTRACT OF POPPIES.—*Take of poppy capsules, dried, freed from the seeds and coarsely powdered,* 1 *pound ; rectified spirit,* 2 *ounces ; boiling distilled water, a sufficiency. Mix the poppy capsules with two pints of the water, and infuse for twenty-four hours, stirring them frequently ; then pack them in a percolator, and adding more of the water, allow the liquor slowly to pass until about a gallon has been collected, or the poppies are exhausted. Evaporate the liquor by a water-bath until it is reduced to a pint, and, when cold, add the spirit. Let the mixture stand for twenty-four hours, then separate the clear liquor by filtration, and evaporate this by a water-bath until the extract has acquired a suitable consistence for forming pills.*

Actions, anodyne and hypnotic. It is believed to be less liable to occasion headache, nausea, constipation, or delirium, than opium ; its actions, however, are similar, but milder and less certain. Its dose is from two to five grains in pill. It was formerly officinal in the Pharmacopœias of both London and Edinburgh.

DECOCTUM PAPAVERIS—DECOCTION OF POPPIES.—*Take of poppy capsules, bruised,* 2 *ounces ; distilled water,* 1½ *pint. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.*

This decoction is employed only externally, as a soothing application. It possesses whatever anodyne ingredients the capsules may contain, and when the seeds are not rejected it is emollient. It is employed as a fomentation to bruised and inflamed surfaces ; to the eye in ophthalmia, to painful tumours, as an injection in painful affections of the vagina or uterus, &c.

SYRUPUS PAPAVERIS—SYRUP OF POPPIES.—*Take of poppy capsules, dried, freed from the seeds and coarsely powdered,* 36 *ounces ; rectified spirit,* 16 *fluid ounces ; refined sugar,* 4 *pounds ; boiling distilled water, a sufficiency. Mix the poppy capsules with four pints of the water, and infuse for twenty-four hours, stirring them frequently ; then pack them in a percolator, and, adding more of the water, allow the liquor slowly to pass until about two gallons have been collected, or the poppies are exhausted. Evaporate the liquor by a water-bath until it is reduced to three pints. When quite cold, add the spirit, let the mixture stand for twelve hours, and filter. Distil off the spirit, evaporate the remaining liquor to two pints, and then add the sugar. The product should weigh six pounds and a half, and should have the specific gravity* 1·320.

This syrup possesses the properties of opium to such an extent as the capsules are capable of yielding them ; but it is at best but an uncertain preparation. The dose will vary with the strength of the preparation and circumstances of the patient, from half-a-fluid drachm, to three or

four fluid drachms. A spurious syrup is not unfrequently made by adding tincture of opium to simple syrup.

Opium—Opium.—*The juice inspissated by spontaneous evaporation, obtained by incision from the unripe capsules of the poppy,—Papaver somniferum,—grown in Asia Minor.*

The method of obtaining opium from poppy capsules, though differing in some of its details, is nearly alike in all the opium-producing countries, and is briefly as follows:—A few days after the fall, or the gathering, of the petals, when the capsules are still unripe, but full of a thick milky juice, the opium collectors incise each capsule by means of a sharp instrument, usually consisting of four or five parallel blades. These incisions are made in the evening, are either transverse, oblique, or perpendicular, according to the fashion of the country, and only extend through the outer layers, great care being taken to prevent the blades penetrating into the interior of the capsule, whereby not only a loss of opium would accrue, but, moreover, the seeds contained within the capsule, from which a bland fixed oil is afterwards obtained, would be rendered valueless. The capsules are scarified rather than incised. During the night the milky juice exudes through the incisions, and on the following morning the collectors pass from plant to plant, scraping the tears of opium from the capsules, and carefully depositing them either upon leaves or in vessels for further manipulation. Upon the state of the weather, and the length of time that is allowed to elapse between incising and collecting, the latter being to a certain extent overruled by the former, will depend the quantity and appearance of the opium. In wet and unsettled weather the opium is generally collected more quickly, and often before the juice has been formed into distinct tears; the yield of opium is greater when the dew is heavy during the night, and it is darker in colour; on the other hand, when the dew is light or absent, the yield of opium is less, and it is of a lighter colour. In windy weather, dust and other impurities adhere to the soft juice, and cannot afterwards be separated.

After its collection from the capsules, the still soft opium is treated in several ways. In Asia Minor, whence the officinal variety is obtained, the tears are generally carefully collected upon poppy leaves, are spread in thin layers, in a warm and airy apartment, in order to become more inspissated, and finally these are united to form convenient masses. When this plan is pursued, the particles remain distinct, and the masses, on careful inspection, are found to consist of minute agglutinated tears. But sometimes the smaller quantities of juice are at once mixed, and are stirred or rubbed together in a kind of mortar, whereby the tears are obliterated, and the opium is made to present a uniform homogeneous appearance. In India the fresh juice is placed in shallow earthen vessels, in which it separates into two parts, one a pinkish coloured granular mass, the other a dark-coloured fluid, resembling infusion of coffee, to which the name of *Pussewah* is given. The latter is afterwards employed in the formation of the shells of the opium cakes, whilst the former is submitted to such operations as entirely destroy its granular character and render it homogeneous. In course of time the better varieties of opium become dark coloured and hard; but there is an inferior kind which, being allowed to undergo fermentation during its preparation,

remains soft for a considerable period. Besides the officinal kind produced in Asia Minor, there are other varieties cultivated in India, Egypt, Persia, and Europe.

The opium of Asia Minor is chiefly produced in the pashalic of Anatolia, between latitudes 36° and 42° N., and longitudes 26° and 35° E. It is known as Turkey or Levant Opium; and again, according to the port from which it is shipped, either as Smyrna or Constantinople Opium. *Smyrna Opium,* the Turkey Opium of commerce, is met with in irregular, but more or less roundish masses, weighing from half-a-pound to two pounds each, and covered with the capsules of a species of rumex. This is deemed the finest variety of the opium of European commerce; it is composed of distinct agglutinated tears, is at first softish, and may be pitted by pressure; when cut, it has a waxy lustre, a hair-brown colour, and a taste and odour *sui generis.* By keeping it becomes dry, hard, and black. It is to this, the superior sample of Turkey Opium, that the following officinal characters refer:—

CHARACTERS.—*Irregular lumps, weighing from four ounces to two pounds; enveloped in the remains of poppy leaves, and generally covered with the chaffy fruits of a species of rumex; when fresh, plastic, tearing with an irregular slightly moist chestnut-brown surface, shining when rubbed smooth with the finger, having a peculiar odour and nauseous bitter taste.*

An inferior kind, homogeneous in structure, darker, and usually covered with poppy leaves, is also exported from Smyrna.

Constantinople Opium may equal Smyrna Opium in value, but is generally regarded as somewhat inferior to it. It is met with in two forms, the one in large irregular cakes, more or less resembling the Smyrna variety, the other in smaller flattened cakes of regular lenticular form, between two and three inches in diameter, and covered with a poppy leaf, the midrib of which is seen crossing the middle of each piece. Constantinople Opium is more mucilaginous than that procured from Smyrna, and is less uniform in quality. It is *granular,* that is, consisting of agglutinated tears, and has more or less of the officinal characters of good opium.

Egyptian Opium is made up to resemble the Constantinople variety, and is met with in roundish flattened cakes, about three inches in diameter, weighing from four to eight ounces each, and covered with a leaf which has not been well ascertained, by some said to be a poppy leaf, by Professor Bentley supposed to be a leaf of the *Platanus orientalis,* but by Guibourt left undetermined. Egyptian Opium is *homogeneous* in structure, has a good appearance, but is inferior to the Turkey varieties, and differs from them in being of a reddish colour, and in not turning black by keeping. It turns soft by exposure to the air, and has not the peculiar taste and odour to the extent of the better varieties of opium.

Indian Opium is cultivated in the large central Gangetic tract, extending between Goruckpore in the north and Hazareebaugh in the south, and between Dingepore on the east and Agra on the west, occupying an area of about six hundred by two hundred miles, which is divided into the Behar and the Benares agencies. Some of the opium is of excellent quality, but much of it is inferior. In consequence of the estimation in

which it is held in the East, and the high prices there given for it, especially by the Chinese, who use it largely for smoking, Indian opium is not met with as an article of European commerce. The chief varieties are :—1. *Bengal Opium*, which is also known as *Benares, Common Patna* or *Behar* and *Chinese Investment Opium.* It is an inferior kind, and is made up into roundish cakes or balls of from three to four pounds in weight, and likened to the appearance of a rusty 24-pound shot. Each ball consists of an outer case and contents. The case is about half-an-inch thick, weighs half-a-pound, and is composed of petals agglutinated by means of *lewah*, which is a thin semi-fluid paste formed by the addition of inferior opium, and the washings of the vessels which contained the better kinds of opium, to the *Pussewah* previously mentioned. The opium contained in the case is soft, black, and homogeneous. 2. *Garden Patna Opium* was prepared in consequence of the complaints made against the quality of the Common Patna variety. It occurs in cakes about four inches square, half-an-inch thick, a quarter of a pound in weight, and carefully packed in wax cases or boxes with interposing layers of mica. It is homogeneous in structure, reddish brown in colour, and generally of considerable value, some of the samples approaching to the characters of the finest Turkey Opium. 3. *Malwa Opium* is met with in flat circular cakes, from four to six inches in diameter, weighing from four to eight or more ounces, generally dry, hard, and brittle, and often cracked at the circumference. It is homogeneous in structure, of a reddish brown colour, and, though variable in quality, usually ranks in point of excellence between the common Bengal and the Garden Patna varieties.

Persian Opium, or *Trebizond Opium*, as it is sometimes called, from having been obtained from that seaport, is either granular or homogeneous in structure, either reddish brown or black in colour, and is made up into sticks of several inches in length, and about the thickness of the little finger, which are pliant, and are wrapped separately in paper tied with cotton thread. It is generally of inferior quality, and is not esteemed.

Other varieties of opium, collectively termed *European*, have been cultivated in Britain, France, Germany, and Greece. But, although in many instances the samples were of considerable value, its production has not generally been commercially successful. Opium has also been cultivated to a small extent in Algeria.

Relative value and purity of the different kinds of Opium. There is no single chemical test for determing the value and purity of the different samples of opium. The quantity of morphia contained in each is to a certain extent an indication of its value; but morphiometry is too tedious and expensive an operation for the opium merchant, who trusts rather to physical than to chemical signs. He is guided in his estimation of the samples chiefly by their colour, odour, and texture, and by these sensible qualities an experienced dealer is seldom misled. But the medicinal value of the drug can only be determined by careful analysis, with the view of ascertaining the relative proportions of its several active ingredients. The results of analyses made by various chemists differ widely both with respect to the same and different kinds of opium. These discrepancies are partly due to the fact, that the relative propor-

tions of the active constituents vary with the locality, season, and other circumstances connected with the cultivation of the drug; but in a great measure they have arisen, no doubt, from the want of a standard of purity to which these ingredients should have been brought before their quantity was estimated. For the fact that one chemist obtains ten or twelve per cent. of morphia, when another can only get five or six, is to be accounted for only by supposing that the smaller quantity has been diminished by its purification being carried much further than in the other case. At least from six to eight per cent. of morphia ought to be obtained from a medicinal sample of opium, and for determining this the pharmacopœia gives the following :—

PURITY TEST.—*Take of opium one hundred grains, slaked lime one hundred grains, distilled water four ounces. Break down the opium, and steep it in an ounce of the water for twenty-four hours, stirring the mixture frequently. Transfer it to a displacement apparatus, and pour on the remainder of the water in successive portions, so as to exhaust the opium by percolation. To the infusion thus obtained, placed in a flask, add the lime, boil for ten minutes, place the undissolved matter on a filter, and wash it with an ounce of boiling water. Acidulate the filtered fluid slightly with diluted hydrochloric acid, evaporate it to the bulk of half-an-ounce, and let it cool. Neutralise cautiously with solution of ammonia, carefully avoiding an excess; remove by filtration the brown matter which separates, wash it with an ounce of hot water, mix the washings with the filtrate, concentrate the whole to the bulk of half-an-ounce, and add now solution of ammonia in slight excess. After twenty-four hours collect the precipitated morphia on a weighed filter, wash it with cold water, and dry it at* 212°. *It ought to weigh at least from six to eight grains.*

This test does not deal with the impurities of opium; it simply demands a certain proportion of morphia, and if that be present, it is for practical purposes a sufficient guarantee of the purity of the drug. Opium has been found to contain from time to time a variety of adulterations; amongst which the following are mentioned by Dr Eatwell as having been met with in the Indian varieties :—The grosser impurities usually mixed with the drug to increase its weight are, mud, sand, powdered charcoal, soot, cow-dung, pounded poppy petals, and pounded seeds of various descriptions. All of these substances are readily discoverable in breaking up the drug in cold water, removing the soluble and lighter portions of the diffused mass by decantation, and carefully examining the sediment. By this means impurities of the above nature usually become physically apparent. Flour is a very favourite article of adulteration, but is readily detected; opium so adulterated speedily becomes sour, it breaks with a peculiar short ragged fracture, the sharp edges of which are dull, and not pink and translucent as they should be, and on squeezing a mass of the drug after immersion in water, the starch may be seen oozing from its surface. The application of the iodine test, however, furnishes conclusive evidence of its presence, or at least of that of some amylaceous compound. The farina of the boiled potato is not unfrequently made use of; ghee and goor (an impure treacle), are also occasionally used, as being articles at the command of most of the cultivators. Their presence is revealed by the peculiar odour and consistence which they impart to the drug. In addition to the above, a variety of

vegetable juices, extracts, pulps, and colouring matters, are occasionally fraudulently mixed with the opium,—such as the inspissated juice of the common prickly pear (*Cactus Dillenii*), the extracts prepared from the tobacco plant (*Nicotiana Tabacum*), the *Datura Stramonium*, and the Indian hemp (*Cannabis Indica*), &c. The gummy exudations from various plants are frequently used; and of pulps, the most frequently employed are those of the tamarind, and of the bael fruit (*Ægle marmelos*). To impart colour to the drug, various substances are employed, as catechu, turmeric, the pounded flowers of the mowha tree (*Bassia latifolia*), &c. Dust, sand, small stones, pieces of metal, bullets, and other foreign substances have also been detected in opium; excessive moisture has been frequently complained of; in some instances substances have been added to simulate a large quantity of the alkaloids; and finally, opium from which the morphia had been abstracted has been sent to the market.

Opium is an exceedingly complex substance, and is even still yielding new constituents to scientific investigation. Some of its ingredients are given up to water, and still more to alcohol and ether; others are separated by chemical processes, and these again form the bases of a series of pharmaceutical preparations. We shall first consider the simple galenical preparations of the drug, with their actions and uses, and afterwards the chief of its active constituents separately.

CONFECTIO OPII—Confection of Opium.

Take of compound powder of opium, 192 *grains; syrup,* 1 *fluid ounce. Mix.*

EMPLASTRUM OPII—Opium Plaster.—*Take of opium, in fine powder,* 1 *ounce; resin plaster,* 9 *ounces. Melt the resin plaster by means of a water-bath; then add the opium by degrees, and mix thoroughly.*

ENEMA OPII—Enema of Opium.—*Take of tincture of opium,* ½ *fluid drachm; mucilage of starch,* 2 *fluid ounces. Mix.*

EXTRACTUM OPII—Extract of Opium.—*Take of opium, in thin slices,* 1 *pound; distilled water,* 6 *pints. Macerate the opium in two pints of the water for twenty-four hours, and express the liquor. Reduce the residue of the opium to a uniform pulp, macerate it again in two pints of the water for twenty-four hours, and express. Repeat the operation a third time. Mix the liquors, strain through flannel, and evaporate by a water-bath until the extract has acquired a suitable consistence for forming pills.*

EXTRACTUM OPII LIQUIDUM—Liquid Extract of Opium.—*Take of extract of opium,* 1 *ounce; distilled water,* 16 *fluid ounces; rectified spirit,* 4 *fluid ounces. Macerate the extract of opium in the water for an hour, stirring frequently, then add the spirit, filter, and the product should measure one pint. It contains* 22 *grains of extract of opium, nearly, in one fluid ounce.*

LINIMENTUM OPII—Liniment of Opium.—*Take of tincture of opium, liniment of soap, of each,* 2 *fluid ounces. Mix.*

PILULA SAPONIS COMPOSITA.—*Synonym* Pilula Opii—Opium Pill. Lond. Dub.—*Take of opium, in powder,* ½ *ounce; hard*

soap, in powder, 2 ounces; distilled water, a sufficiency. Mix the opium and soap, and beat into a mass with the water.

PULVIS CRETÆ AROMATICUS CUM OPIO—AROMATIC POWDER OF CHALK AND OPIUM.—*Take of aromatic powder of chalk, 9¾ ounces; opium in powder, ¼ ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.*

PULVIS OPII COMPOSITUS—Compound Powder of Opium.

PREPARATION.—*Take of opium, in powder, 1½ ounce; black pepper in powder, 2 ounces; ginger in powder, 5 ounces; carraway fruit in powder, 6 ounces; tragacanth in powder, ½ ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.*

TINCTURA OPII—TINCTURE OF OPIUM (Laudanum).—*Take of opium, in coarse powder, 1½ ounce; proof spirit, 1 pint. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, filter, and add sufficient proof spirit to make one pint.*

TINCTURA OPII AMMONIATA—AMMONIATED TINCTURE OF OPIUM.—*Synonym:* Scotch Paregoric Elixir.—*Take of opium, in coarse powder, 100 grains; saffron, cut small, benzoic acid, of each, 180 grains; oil of anise, 1 fluid drachm; strong solution of ammonia, 4 fluid ounces; rectified spirit, 16 fluid ounces. Macerate for seven days in a well-closed vessel, with occasional agitation, then strain, press, filter, and add sufficient rectified spirit to make one pint.*

TROCHISCI OPII—OPIUM LOZENGES.—*Take of extract of opium, 72 grains; tincture of tolu, ½ fluid ounce; refined sugar, in powder, 16 ounces; gum acacia, in powder, 2 ounces; extract of liquorice, 6 ounces; distilled water, a sufficiency. Add the extract of opium, first softened by means of a little water, and the tincture of tolu, to the extract of liquorice heated in a water-bath. When the mixture is reduced to a proper consistence, remove it to a slab, add the sugar and gum previously rubbed together, and mix thoroughly. Divide the mass into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains one-tenth of a grain of extract of opium.*

VINUM OPII—WINE OF OPIUM.—*Take of extract of opium, 1 ounce; cinnamon bark bruised, cloves bruised, of each, 75 grains; sherry, 1 pint. Macerate for seven days in a closed vessel, with occasional agitation, and filter.*

Opium is likewise a principal ingredient in the following officinal preparations, the formulæ for which are given elsewhere:—*Pilula Ipecacuanhæ cum Seilla, Pilula Plumbi cum Opio, Pulvis Ipecacuanhæ Compositus, Pulvis Kino, Tinctura Camphoræ Compositus, Unguentum Gallæ cum Opio.*

Dose.—The following is a list of all the officinal, and the chief of the popular non-officinal preparations, of which opium, or one of its active constituents, forms the principal ingredient. The dose, of course, will vary according to the age and habits of the patient, the nature of the

disease, and the object of its administration. The doses here given are for adults.

a. Officinal—

1. *Solid Opium* may be given in the crude or powdered form, in doses extending from one-sixth of a grain up to four or five grains, but the latter only in extraordinary cases.
2. *Confectio Opii* corresponds pretty closely with the confection of opium, *L.* Its actions and uses are the same as those of the compound powder of opium given below, only it presents the choice of a different form of administration. *Dose,* five to twenty grains.
3. *Emplastrum Opii* is used as a strengthening and anodyne application in lumbago, rheumatic, neuralgic, and other painful affections.
4. *Enema Opii* is administered in painful affections of the parts in the vicinity of the rectum, and when the drug cannot conveniently be given in the ordinary way. It is doubtful whether more opium can safely be given by the rectum than by the stomach: opinions differ, some physicians believing that more, others that less should be given by the rectum. The most common practice is to administer one-half more by the bowels than by the mouth. The officinal enema contains half-a-fluid drachm of the tincture.
5. *Extractum Opii* is an aqueous preparation. It contains the active ingredients of opium without the inert principles and impurities of the crude drug, and therefore should be relatively stronger; but, practically, the dose is the same as that of crude opium. It has the advantage of being soluble in water, and is said to give rise to less constitutional disturbance than some of the other preparations. Good opium should yield from 50 to 70 per cent. of this extract.
6. *Extractum Opii Liquidum* is the officinal representative of *Battley's Sedative Solution.* It is about one-seventh stronger than the tincture, and should be given in somewhat smaller doses; but Mr Squire states that the quantity of spirit in the officinal preparation is insufficient to preserve it, and suggests that it should be doubled, whereby the liquid extract would be reduced to the strength of the tincture and the wine. *Dose* of the officinal preparation, ten to forty minims.
7. *Linimentum Opii*—a local anodyne application to sprains, rheumatic, and neuralgic pains.
8. *Pilula Saponis Composita.*—Strength, one grain of opium in five of the pill mass. *Dose,* two or three to ten grains, and may be used as a suppository.
9. *Pulvis Cretæ Aromaticus cum Opio.*—Strength, one grain of opium in forty of the powder. *Dose,* ten to forty grains, in diarrhœa.
10. *Pulvis Opii Compositus* is aromatic and narcotic, useful as an adjunct to chalk mixture and other astringent substances in

the cure of diarrhœa. It is also used in flatulent colic. It represents very nearly the dry ingredients of the Confectio Opii, L. It is employed in the preparation of *Confectio Opii*, of which it forms one part in four nearly. *Dose,* two to five grains.

11. *Tinctura Opii.*—The spirituous solution of opium contains all the active ingredients of opium, and acts more promptly than the solid preparations. Strength, one grain of opium in fourteen and one-third minims. *Dose,* ten to forty minims.

12. *Trochisci Opii.*—Each lozenge contains one-tenth of a grain of extract of opium. *Dose,* one to six lozenges occasionally.

13. *Vinum Opii.*—Strength (1 in $14\frac{1}{3}$) and dose (10 to 40 minims), same as the tincture. It is used in ophthalmia, either dropped into the eye or added to collyria.

14. *Pilula Ipecacuanhæ cum Scilla.*—Strength, about three-tenths of a grain of opium in five. (See under Ipecacuanha.)

15. *Pilula Plumbi cum Opio.*—Strength, one grain of opium to eight grains of the pill mass. *Dose,* one four-grain pill, or more. (See under Lead.)

16. *Pulvis Ipecacuanhæ Compositus.*—Ten grains of the powder contain one of ipecacuan, one of opium, and eight of sulphate of potash. *Dose,* five to fifteen grains. (See under Ipecacuanha.)

17. *Pulvis Kino Compositus.*—Strength, one grain of opium in twenty. *Dose,* five, ten, or more grains. (See under Kino.)

18. *Tinctura Camphoræ Composita.*—Strength, two grains of opium in one fluid ounce. *Dose,* thirty minims to three fluid drachms. (See under Camphor.)

19. *Tinctura Opii Ammoniata—Scotch Paregoric.*—An ounce contains five grains of opium, so that it is $2\frac{1}{2}$ times as strong as the camphorated tincture, which is commonly known by the name of *English Paregoric.* *Dose,* one-half to one fluid drachm.

20. *Unguentum Gallæ cum Opio.*—Strength, one grain of opium in fourteen and two-thirds. (See under Galls.)

21. *Morphiæ Acetas.*—*Dose,* one-eighth to one-half of a grain; the hydrochlorate is preferable.

22. *Liquor Morphiæ Acetatis.*—Strength, same as the solution of the hydrochlorate. *Dose,* ten to forty minims.

23. *Morphiæ Hydrochloras.*—*Dose,* one-eighth to one-half of a grain; endermically, from one to two grains.

24. *Liquor Morphiæ Hydrochloratis.*—Strength, four grains to the fluid ounce, or half-a-grain to the fluid drachm. *Dose,* ten to forty minims.

25. *Trochisci Morphiæ.*—Strength, each lozenge contains one thirty-sixth of a grain of hydrochlorate of morphia. *Dose,* one to six lozenges occasionally.

26. *Trochisci Morphiæ et Ipecacuanhæ.*—Strength, each lozenge contains one thirty-sixth of a grain of hydrochlorate of morphia, and one-twelfth of a grain of ipecacuanha. *Dose,* one to six lozenges occasionally.

27. *Suppositoria Morphiæ.*—Each suppository contains one-fourth of a grain of hydrochlorate of morphia.

b. Non-officinal.

1. *Morphia.—Dose,* one-quarter to one-half of a grain; not used, in consequence of its insolubility.
2. *Syrupus Morphiæ Acetatis* (D.P.)—*Dose,* one fluid drachm, or more.
3. *Syrupus Morphiæ Hydrochloratis* (D.P.)—*Dose,* one fluid drachm, or more.
4. *Morphiæ Sulphas* (U.S.P.)—*Dose,* one-eighth to one-quarter of a grain.
5. *Liquor Morphiæ Sulphatis* (U.S.P.)—Strength, one grain to the ounce. *Dose,* one fluid drachm, or more.
6. *Syrupus Morphiæ Sulphatis* (Paris Codex).—Strength, one quarter of a grain of the sulphate in each ounce. *Dose,* two fluid drachms, or more.
7. *Solutio Morphiæ Bimeconatis* (Squire).—Strength and dose, same as tincture of opium. Said to interfere less with the head, stomach, and bowels, than other preparations of morphia, but this is exceedingly doubtful. It is the common form in which morphia is injected subcutaneously. But it is then usually made double strength, and from ten to twenty minims are sufficient for one injection.
8. *Liquor Opii Sedativus* (Battley).—Strength about 40 per cent. above that of tincture of opium. *Dose,* five to twenty minims. Used as an anodyne and sedative, superior to the tincture.
9. *Black Drop.*—Strength, one drop equal to four of the tincture of opium. *Dose,* four to ten minims.
10. *Nepenthe* (Ferris).—*Dose,* same as tincture of opium.
11. *Pilula Calomelanos et Opii* (E.P.)—Each pill contained two grains of calomel and two-thirds of a grain of opium. *Dose,* one or two pills.
12. *Electuarium Opii* (E.P.)—Strength, one grain of opium in forty-three. *Dose,* ten to sixty grains.
13. *Acetum Opii* (E. & D.P.)—Strength of the Edinburgh preparation, four ounces of opium to sixteen fluid ounces of distilled vinegar; the Dublin preparation was about equal to the tincture. *Dose* of the former, five to twenty minims; of the latter, ten to forty minims.
14. *Pilula Opii sive Thebiacæ* (E.P.)—Strength, one grain of opium in five.
15. *Pilula Styracis Composita* (L.P.)—*Pilula Styracis* (E.P.)—Strength, one grain of opium in five.
16. *Unguentum Opii* (L.P.)—Strength, twenty grains of powdered opium to the ounce of lard.

Antidotes.—There is no satisfactory chemical antidote. The indications of treatment are—1. To reduce the quantity of poison as much as

possible, by removing from the stomach that which still remains unabsorbed. This will be most readily and completely effected by the stomach pump, by means of which the stomach is not only to be emptied, but also to be thoroughly washed out with tepid water. In the absence of the stomach pump, or until it is procured, the evacuation of the stomach may be attempted by vomiting; but in many cases neither emetics, nor the irritation produced by tickling the fauces with a feather, avail; nevertheless, both are to be tried. Those emetics are to be employed which do not promote the absorption of the poison by causing depression; the best are, mustard and water, as being most likely to be at hand, sulphate of zinc, or sulphate of copper. If the patient be unable to swallow, an emetic may be injected into the rectum. 2. To neutralise the poison either chemically or physiologically. Substances containing tannic acid, such as infusion of galls, cinchona, tea, &c., may be used with the view of forming an insoluble tannate of morphia; but the action is uncertain, for the tannate is only *comparatively* insoluble. The preparations of Belladonna or Stramonium may be cautiously given with the view of opposing the physiological action of the opium. 3. To preserve the patient from lethargy, and to sustain the vital powers for several hours until the effects of the poison have passed off. The tendency to lethargy may be combated by a variety of annoyances and shocks, amongst which the following have been commonly resorted to: employing men to walk the patient constantly about the room (this may be carried too far, especially if there be a tendency to syncope); tickling the soles; dashing cold water over the face, chest, and spine; flagellation; loud interrogation; sinapisms to the soles and calves; and finally, repeated shocks from an electro-magnetic apparatus, and artificial respiration *continued for some time even after the hope of recovery is lost.* Amongst internal remedies, the following have been recommended: strong coffee or tea; ammonia, either swallowed or inhaled (being careful not to administer it of too great strength, bearing in mind that the patient cannot complain of pain); camphor, musk, brandy.

Opium, in over-doses, acts as a powerful narcotic poison, varying in the rapidity, manner, and intensity of its effects according to the susceptibility of the patient and the quantity and form of the drug employed. The number of cases of poisoning by opium, or one of its preparations, especially *laudanum*, by far exceeds that by any other of the substances popularly called poisons; but, happily, the number of recoveries from opium poisoning is also very large. We shall briefly consider the effects of opium under the following heads:—1. Sudden, or acute poisoning, or poisoning by one excessive dose. 2. Chronic, or slow poisoning, opium eating and smoking. 3. Medicinal effects. 4. Peculiarities.

1. The following are the symptoms which are usually observed after an excessive dose of opium, in the case of a person not accustomed to the drug. The excitement which follows and continues for some time after a smaller dose, is of short duration, and some-

times not perceptible ; the patient soon becomes giddy and stupid ; he is very drowsy, and craves the indulgence of sleep ; when left alone, he lies motionless and in a state of sopor, from which he can still be roused by loud appeals or shaking. But these impressions immediately pass off, and he falls again into a state of stupor, which gradually deepens until, at length, he becomes utterly insensible and comatose ; nevertheless, treatment is by no means to be abandoned, for by the assiduous application of galvanism and artificial respiration, remarkable recoveries have occurred. During this time, the *pulse* is at first small and quick, afterwards slow and full, and at last feeble, flickering, or imperceptible ; the *breathing* is at first hurried, then slow and stertorous ; the *countenance* is at first placid and pale, then ghastly ; the *eyelids* are closed ; the *pupils* are almost always closely contracted ; the *skin* is at first warm and moist, then cold and clammy ; the *voluntary muscles* are relaxed and powerless ; vomiting and purging sometimes occur, and occasionally convulsions precede death. The breath may have the peculiar odour of opium. The symptoms of poisoning generally make their appearance within an hour of the time at which the drug was taken, sometimes within a few minutes, but occasionally not until two or more hours have elapsed ; if the stomach contains food, if the opium be taken in the solid form, or, it is also said, if the person be intoxicated at the time, the symptoms will supervene slowly, and *vice versâ.* Fatal cases usually terminate in from six to twelve hours after the poison has been taken ; but there are some cases in which death takes place very rapidly, and others in which the patient partially recovers, so far as to be able to converse rationally with those around him, then suffers a relapse, and dies after some days. When the patient survives twelve hours, and is restored to consciousness, there is good prospect of his complete recovery ; he then falls into a sound sleep, which may continue from twenty-four to thirty-six hours, from which he awakes to suffer the distressing after-effects such as headache, vertigo, nausea, vomiting, loss of appetite, and general debility. It is difficult to state accurately the poisonous dose of opium or any of its compounds, as so much depends on the susceptibility of the individual, the purity of the drug, and the relative strength of the preparations ; but it must be borne in mind, that whilst comparatively large doses produce but little effect in some people, and in certain diseases, and whilst some persons have recovered after taking enormous doses ; on the other hand, there are cases on record in which far less than

the ordinary medicinal dose has given rise to alarming symptoms. Infants and children are very susceptible of the influence of opium. A single drop of laudanum has proved fatal, and complete narcotism is very commonly the result of two or three drops of laudanum, or an equivalent of Godfrey's cordial or other opiate nostrum, when given to infants.

2. A good deal has been written in the attempt to prove that the practice of opium-eating and of opium-smoking is not so detestable, as other writers would make it appear ; but the utmost that can be said in its favour, is that it is not a greater vice than many others, especially spirit-drinking. Both practices are ultimately destructive of health and happiness to a degree quite incommensurate with the fleeting and selfish enjoyment which, for a time, they may afford, and it certainly adds but little to the merit of the one to say that it is not so pernicious as the other. Amongst the writers who have witnessed the effects of opium-smoking in China and in Turkey, some have recorded the dark side of the picture alone; whilst others, to counterbalance this, have run only to the opposite extreme ; but wherever a faithful account of its effects upon all classes is given, we find that, as a rule, it tends to misery. In this country, the practice of opium-eating, in one form or other, is carried to a deplorable extent ; and it is but small consolation to say that it is less injurious to the health and less brutalising than dram-drinking. Both tend ultimately to destroy life ; for although there are many exceptional cases of both drunkards and opium-eaters attaining the full term of years, still the rule in both is a rapid and a short career. If alcohol is more rapid in its injurious effects, opium is more sure; a man may keep alcohol in its proper place as an article of diet and as a medicine, but it is almost impossible in this climate for any person to retreat from the miserable cravings of an opium-eater. Opium-eating usually begins in the taking of medicinal doses of the drug, for the purpose of relieving a cough, allaying a pain, or checking a diarrhœa ; or it is substituted by the drunkard for his quondam dram, as being a newer and more attractive stimulant; or it is resorted to by those who move in the higher circles of society, as being less easy of detection than alcoholic stimulants ; or it is appealed to by the brain-worn man of letters to revive his drooping energies, or by the poet and the painter to intensify their imaginative powers. For these purposes, the object of the opium-eater is to produce and prolong the first stage of poisoning ; at first small doses, as half-a-grain to one or two grains will produce the

desired effect, but ultimately one, two, or even three, or more drachms of the crude drug will scarcely suffice to sustain its victim for a day. Under the exciting influence of opium, work, of whatever kind, is executed with the least effort; that which without such adventitious stimulus would be produced only by intense application, under the influence of opium flows almost spontaneously. The mind of the opium-eater dwells calmly but fixedly upon his chosen schemes; the poet and the painter regale themselves upon imaginary scenes of beauty, the engineer overcomes difficulties which were otherwise impossible, the philosopher penetrates more deeply, the orator takes a higher flight, the *litterateur* becomes more ornate, and, upon the authority of De Quincey, "if a man whose talk is of oxen should become an opium-eater, the probability is that, if he is not too dull to dream at all, he will dream about oxen." But then, it is to be remembered that opium conveys no information; it will neither make a stupid man brilliant, nor an ignorant man learned —it evokes merely that which was previously in the man; it would be in vain, therefore, to resort to opium-eating with the view of effacing past neglect or of superseding study. And even as an aid to genuine work, or for whatever purpose the habit may be engendered, it behoves the dabbler in opium-eating seriously to count the cost before he commits himself to a practice which he would probably never relinquish. The sting of opium-eating rankles in the breast throughout a life-long retribution. Either by a timely resolution, therefore, supported by medical treatment if necessary, he must at once resist the craving and flee from his adversary; or, as a confirmed opium-eater, he must deliver himself a prey to the constant and increasing demands of his inexorable taskmaster, and so induce a state of mind and body which no achievements, however brilliant, can mitigate, and which no reputation, however lasting, could compensate. And, moreover, the opium-eater cannot long hide his weakness from the world; sooner or later he is betrayed by his withered frame, his sallow countenance, and his preternaturally bright and deep-set eyes, by his bent back, his tottering gait, and his premature old age. His opium supplants his food, his appetite and digestive powers being impaired; his physicial strength diminishes, and his spirits droop. When seen in the morning before he has had his dose, he presents all the feebleness and decay, without the venerable appearance, of old age; but soon after he has swallowed his potion he freshens up wonderfully, puts on an air of active vigour, and follows his accustomed pursuits as before. This state, however, is

only purchased by increasing supplies of the drug ; but even the largest doses at length fail ; his intellect follows the wreck of his body; and finally, either through shame or abject misery, the wretched victim of this degrading habit either falls by his own hand or dies in hopeless impotency. There are cases, however, in which the prolonged use of opium, even in very large doses, is necessary to carry patients through the sufferings which attend their diseases ; and many instances are recorded of persons having recovered under such circumstances, who neither subsequently continued the use of the drug, nor felt any evil effects from the large quantity previously taken. And there are other cases in which the use of opium is continued until death, to mitigate the sufferings arising from chronic disease, without producing the demoralising effects above referred to. But such cases as these differ completely from those in which opium is employed as a source of sensual gratification.

3. As a medicine, opium has been classed with narcotics, hypnotics, anodynes, stimulants, sedatives, calmatives, diaphoretics, anti-spasmodics, anti-periodics, anti-dysenterics, anti-hysterics, febrifuges, &c. The nature and relative extent of the several effects produced by the drug will depend chiefly upon the temperament, idiosyncrasy, habit and condition of the patient, the time of day or night at which it is taken, and the circumstances surrounding the patient. Small doses, not exceeding one grain, generally act, in persons not accustomed to the drug, as stimulants, quickening the circulation, and inducing that clear, lively, and imaginative state of mind already referred to ; the face is usually flushed at this stage, the eyes preternaturally bright, and there is at first a sensation of fulness in the head. This, the first or excitement stage of opium poisoning, is longer continued in proportion to the smallness of the dose employed to produce it, and it is this stage that the opium eater and smoker endeavours to prolong ; but whilst in him the tendency to sleep has by habitual resistance been overcome, in the case of the unaccustomed patient, the soporific influence of the opium soon follows, and after a sleep, less refreshing than "Nature's sweet restorer," he awakes in a state of general discomfort. When it is necessary, as for the relief of pain, or other cause, to repeat such doses, they gradually lose their power, and must be proportionately increased to produce the desired results. The action of opium upon the cerebro-spinal system is observed in the excitement and subsequent depression and sopor of moderate doses, and in the diminished sensibility, contracted pupil, loss of muscular power, and

final coma of poisonous quantities; its action upon the vascular system is observed in the variable effects produced upon the pulse, the turgidity of the countenance, and the sensation of fulness in the head; its action upon the respiratory system is observed in the early hurried and later slow and stertorous breathing; its action upon the alimentary canal is observed in the dryness of the mouth and throat, increased thirst, diminished appetite, and constipation, in the sallow, bilious appearance of the countenance, in the impaired powers of digestion, and in the diminished sensibility of the stomach to the influence of emetics; but sometimes also in the production of nausea and vomiting, and it is to be remembered that some of these effects, especially constipation, are not constant to the opium-eater, as it is very common to find diarrhœa of thin serous stools accompanying this habit; its action upon the urinary organs is observed in the commonly diminished quantity of urine, whether caused by a less secretion by the kidneys, or by retention in the bladder, and in the relief from pain produced by calculi; its action upon the organs of generation is observed in the manifestation of the aphrodisiac properties of the drug when employed in moderation, and in the impotency which follows its abuse, both of these results, however, being probably due to the general condition of the system, rather than to any specific action upon these organs; it does not materially interfere with the functions of the uterus, nor check the secretion of milk, although it renders it narcotic; its action upon the skin is observed in the diminished sensibility which it produces, in the increase of perspiration (the only secretion which is unequivocally increased by it), in the itchiness which is felt by some persons, and in the eruption which occasionally follows its use.

When applied externally, opium acts either topically, and is thus frequently useful in allaying superficial pain, or generally, by its absorption into the system. It is not likely to act upon the system, however, when merely applied to the cuticle, nor even when rubbed upon it. Dr Eatwell states that during the Indian opium season, the native Purkhea sits usually from six A.M. to three P.M. daily, with his hand and arm immersed nearly the whole time in the drug, which he is constantly smelling, and yet he feels no inconvenience from it; and that in the large caking vats, men are employed to wade knee-deep through the drug for several hours during the morning, and they remain standing in it during the greater part of the rest of the day, serving out opium by *armsful*, their bodies being

naked, with the exception of a cloth about the loins. At the commencement of the season, the Purkhea usually experiences a sensation of numbness in the fingers, which Dr Eatwell attributes rather to fatigue than to any effect of the opium ; and the vat-treaders feel somewhat drowsy towards the end of their day's work, and fall asleep early in the evening ; but this effect he attributes rather to the action of the drug through the lungs than through the skin. Beyond such trifling symptoms, these men experience no bad effects from the opium. But when applied endermically or hypodermically, opium and its active constituents act, if not more so, at least as rapidly and powerfully as when given by the stomach.

Opium and its preparations are used for so many purposes, in so many diseases, and in combination with so many drugs, that it is quite beyond the scope of the *Note-Book* even to mention all of them. *In continued fever*, opium is frequently of great benefit in subduing nervous excitement, delirium, tremor, restlessness, and insomnia. Its administration, however, under these circumstances, demands the greatest caution and nicest discrimination to prevent dangerous results, and it should only be administered when the physician is convinced that his patient runs decidedly greater risk of sinking from the watchfulness and delirium than of being injuriously affected by the opium. It is also employed for similar purposes during the course of exanthematic fevers ; in intermittents it is administered as an antiperiodic. *In inflammation*, it is largely employed to allay pain, to operate as an antiphlogistic, alone or in combination with calomel, tartar emetic, or other drug, to act as an antispasmodic, and to check hyper-secretion. *In diseases of the nervous system*, it is employed to allay pain, as in neuralgia, to procure sleep, as in nervous watchfulness, and in some cases of delirium tremens. In the latter affection it ought never to be given in excessive doses, and its tendency to stimulate is greatly lessened by combination with tartarated antimony ; it is also employed with advantage in certain forms of insanity, such as acute mania and puerperal mania. *In convulsive and spasmodic diseases*, it has been largely used, as in epilepsy, chorea, tetanus, puerperal convulsions, whooping cough, spasmodic asthma, colic, in all spasmodic affections of the alimentary canal, in spasmodic stricture of the urethra. *In diseases affecting the respiratory organs*, when carefully administered, it is of advantage, as in catarrh, influenza, phthisis, spasmodic asthma, and whooping cough, besides the inflammatory affections of the respiratory organs. In some cardiac affections. *In diseases affecting the*

alimentary canal it is frequently used, as in certain forms of vomiting, gastralgia, ulcer of the stomach, diarrhœa, cholera, dysentery, intus-susception, strangulated hernia. *In diseases affecting the genito-urinary organs* it is employed, as in inflammatory affections of the kidney, to allay the irritation produced by calculi in any part of the urinary canal, in inflammatory affections and irritable conditions of the bladder, and of the uterus and its appendages, and in functional derangements of these organs at the periods of menstruation, pregnancy, and delivery. *In diseases affecting the organs of locomotion* it is used, as in rheumatism, gout, phlegmasia dolens, ulcerations, and mortification of the extremities. Besides the diseases now mentioned, opium and its preparations are given in very many others, such as cancer, hemorrhages, chronic coughs, during the passage of calculi through the gall ducts or ureters, in diabetes mellitus or insipidus, in hydrophobia, in hydrocephalus, in cynanche tonsillaris, in ptyalism, in venereal diseases, as antidotes in poisoning by Belladonna and Stramonium, and in irritant poisoning, &c., &c. As topical applications, opiates are applied in superficial neuralgic affections, in certain irritable cutaneous diseases, in affections of the eye, ear, and throat, in toothache, in pleurodynia, rheumatic pains, &c. *Endermically*, they are frequently applied by first removing the cuticle by means of a blister, and then sprinkling the exposed surface with morphia or other preparations; and *hypodermically*, by injecting a solution of one of the preparations (commonly that of bimeconate of morphia) into the subcutaneous cellular tissue. Enemata, suppositories, fomentations, and plasters, are other modes of local application.

4. In many of the diseases mentioned as suitable for treatment by opiates, there may be conditions in which their employment would be highly injurious, and such cases cannot always be met by general rules; there are, however, certain signs which are considered to be contra-indicative of the use of opiates, the chief of which, together with certain modifying circumstances and peculiarities in the operation of these drugs, can be but very briefly mentioned. 1. The circumstances which modify the effects of opium are divisible into those which are attributable to the patient, and others which belong to the drug. Of the former, age, sex, temperament, idiosyncrasy, habit, and condition, are the chief; *infants and children* are very susceptible of the influence of opium, and alarming symptoms are sometimes produced by the smallest doses; women are commonly more excited than men by opiates, and when unaccustomed to the

drug, do not tolerate it in so large doses ; nervous temperaments are sometimes soothed, but often highly excited by opiates, melancholic patients are less influenced by them, whilst those of sanguine temperament are usually most uniformly affected. By idiosyncrasy, some patients cannot take the smallest dose of opium, or any of its preparations, without suffering great discomfort, and it is essential to ascertain whether such be the case before prescribing opiates to a stranger ; in these cases other drugs may be substituted ; by habit persons may acquire the power of taking enormous doses without producing poisonous symptoms ; some diseases, especially those attended by severe pain or spasm, increase the tolerance of opium to a considerable degree. Of the latter, the cultivation, purity, age, pharmaceutical form, and combination with other drugs, modify the effects of opiates. 2. Opiates are, as a general rule, contra-indicated under the following circumstances :—When there is a tendency to sopor or coma, and especially when the pupil is contracted ; in plethoric constitutions, with congestion of the cerebral vessels ; in cases of venous congestion ; in pulmonary affections when the expectoration is scanty and difficult, and also in certain conditions in which there is a copious secretion from the air passages ; in inflammatory diseases, whilst it is given to allay pain, it must not be allowed to stupefy the patient and mask the disease, as an antiphlogistic in such cases it must be combined with other drugs of more direct action, and it is more useful in membranous, than in parenchymatous inflammations ; in cases in which the urine is scanty and high coloured, alkalies should either be given before or with the opiate, &c.

Constituents of Opium.—Morphia, codeia, thebaia or paramorphia, narcotine, narcein, cryptopia, meconine, porphyroxin, opianine, papaverine, pseudo-morphine, meconic acid, sulphuric acid, volatile oil, fixed oil, resins, gum, albumen, extractive, caoutchouc, lignin, salts of inorganic bases, &c.

MORPHIA.—Morphia is the most important constituent of opium, and is obtained from it in proportions varying from two or three to ten or twelve per cent. Its constitution is variously stated, but the most common formula given for it is $C_{17}H_{19}NO_3$. Morphia being insoluble in water, is rarely used in medicine ; it is not officinal, but was formerly so in the London and Dublin Pharmacopœias. It is obtained in the process for the preparation of its officinal salts, the hydrochlorate. When obtained from its alcoholic solution, morphia occurs in brilliant, colourless six-sided prisms, with dihedral terminations ; but it is commonly met with as a white powder. Morphia is nearly insoluble in cold water ; boiling water dissolves about one-hundredth of its weight, giving an

alkaline solution ; it is soluble in forty parts of cold anhydrous alcohol, and in thirty parts of alcohol at 212°. It is dissolved by potash and soda, and by ammonia when added in excess ; these reagents, therefore, should be used cautiously when employed for the precipitation of the alkaloid. It is inodorous, but has a very bitter taste. Nitric acid turns it first red, and afterwards yellow. Neutral perchloride of iron gives a greenish-blue colour. It deoxidises iodic acid, setting free iodine, and thus gives a characteristic reddish-brown colour, which in the presence of starch gives the blue iodide of starch. Morphia may be given in doses of one-quarter to one-half of a grain, but is seldom employed.

Morphiæ Hydrochloras—*Hydrochlorate of Morphia.*—Synonym : *Morphiæ Murias,* Ed. Dub. *The hydrochlorate of an alkaloid,* ($C_{34}H_{19}NO_6$, $HCl + 6HO$, or $C_{17}H_{19}NO_3HCl3H_2O$,) *prepared from opium.*

PREPARATION.—*Take of opium sliced,* 1 *pound; chloride of calcium,* $\frac{3}{4}$ *ounce; purified animal charcoal,* $\frac{1}{4}$ *ounce; diluted hydrochloric acid,* 2 *fluid ounces, or a sufficiency; solution of ammonia; and distilled water; of each, a sufficiency. Macerate the opium for twenty-four hours with two pints of the water, and decant. Macerate the residue for twelve hours with two pints of the water, decant, and repeat the process with the same quantity of the water, subjecting the insoluble residue to strong pressure. Unite the liquors, evaporate on a water-bath to the bulk of one pint, and strain through calico. Pour in now the chloride of calcium previously dissolved in four fluid ounces of distilled water, and evaporate until the solution is so far concentrated that upon cooling it becomes solid. Envelope the mass in a double fold of strong calico, and subject it to powerful pressure, preserving the dark fluid which exudes. Triturate the squeezed cake with about half-a-pint of boiling distilled water, and the whole being thrown upon a paper filter, wash the residue well with boiling distilled water. The filtered fluids having been evaporated as before, cooled, and solidified, again subject the mass to pressure; and if it be still much coloured, repeat this process a third time, the expressed liquids being always preserved. Dissolve the pressed cake in six fluid ounces of boiling distilled water; add the animal charcoal, and digest for twenty minutes; filter, wash the filter and charcoal with boiling distilled water, and to the solution thus obtained add the solution of ammonia, in slight excess. Let the pure crystalline morphia which separates as the liquid cools, be collected on a paper filter, and washed with cold distilled water until the washings cease to give a precipitate with solution of nitrate of silver acidulated by nitric acid.*

From the dark liquids expressed in the above process, an additional product may be obtained by diluting them with distilled water, precipitating with solution of potash added in considerable excess, filtering, and supersaturating the filtrate with hydrochloric acid. This acid liquid, digested with a little animal charcoal, and again filtered, gives upon the addition of ammonia a small quantity of pure morphia.

Diffuse the pure morphia, obtained as above, through two fluid ounces of boiling distilled water placed in a porcelain capsule kept hot, and add, constantly stirring, the diluted hydrochloric acid, proceeding with caution, so that the morphia may be entirely dissolved, and a neutral solution obtained. Set aside to cool and crystallise. Drain the crystals, and dry them on

filtering paper. By further evaporating the mother liquor, and again cooling, additional crystals are obtained.

Rationale.—The liquor which is obtained by macerating the opium in water, contains morphia and codeia; also, in smaller quantities, thebaia, narcotin, narcein, and meconin, together with resin, extractive, colouring matter, fatty oil, &c. The morphia, codeia, &c., are in combination with meconic and sulphuric acids. On the addition of chloride of calcium, a double decomposition takes place, meconate and sulphate of lime being precipitated, while hydrochlorates of morphia, codeia, &c., are left in solution; these, with the other constituents, are contained in the solid mass obtained by evaporation. By pressure, a good deal of the colouring matter and extractive are separated in the dark fluid which also contains a little of the hydrochlorates; this part of the process is repeated as often as may be necessary to obtain the hydrochlorates in a tolerably pure state. The cake which remains after the final pressing, is next completely decolorised by solution in water, digestion with charcoal, and filtration. The solution now contains the hydrochlorates of morphia and codeia, almost pure. Ammonia is next added, whereby morphia is separated and precipitated, whilst the hydrochlorates of ammonia and codeia remain in solution. Care must be taken not to add too much ammonia, which would redissolve the morphia. When the washings cease to give a precipitate with the acidulated solution of nitrate of silver, the morphia is free from hydrochlorates, and is then ready for solution in the water and hydrochloric acid, thereby being converted into hydrochlorate, which is separated by crystallisation. A smaller quantity of morphia is also obtained from the dark-coloured liquids, by the process given in the middle paragraph of the officinal instructions.

CHARACTERS.—*In white flexible acicular prisms of a silky lustre, not changed by exposure to the air, and soluble in water and spirit. The aqueous solution gives a white curdy precipitate with nitrate of silver,*[1] *and a white one with potash, which is redissolved when an excess of the alkali is added.*[2] *Moistened with strong nitric acid it becomes orange-red,*[3] *and with solution of perchloride of iron, greenish-blue.*[3]

PURITY TESTS.—*Entirely destructible by heat, leaving no residue.*[4] *Twenty grains of the salt dissolved in half-an-ounce of warm water, with ammonia added in the slightest possible excess, give on cooling a crystalline precipitate which, when washed with a little cold water, and dried by exposure to the air, weighs* 15·18 *grains.*[5] PREPARATIONS.—*Liquor, Suppositoria, Trochisci, Trochisci Morphiæ et Ipecacuanhæ.*

[1] Characteristic of a hydrochlorate; the precipitate is soluble in ammonia, but is insoluble in nitric acid and in hydrochloric acid. [2] Morphia being first precipitated and then redissolved. [3] Characteristic of a salt of morphia. [4&5] Morphia may contain salicin (which turns red when pure sulphuric acid is added), white sugar, colouring matter, moisture, &c., the absence of which is determined by the tests, there being in the former case no fixed residue, and in the latter, the correct quantity of pure morphia.

LIQUOR MORPHIÆ HYDROCHLORATIS — SOLUTION OF HYDROCHLORATE OF MORPHIA.—*Take of hydrochlorate of morphia,* 4

grains; diluted hydrochloric acid, 8 *minims; rectified spirit,* 2 *fluid drachms; distilled water,* 6 *fluid drachms. Mix the hydrochloric acid, the spirit, and the water, and dissolve the hydrochlorate of morphia in the mixture.* This solution contains half as much morphia as liquor morphiæ hydrochloratis, Lond.

SUPPOSITORIA MORPHIÆ—Morphia Suppositories.—*Take of hydrochlorate of morphia,* 6 *grains; benzoated lard,* 64 *grains; white wax,* 20 *grains; oil of theobroma,* 90 *grains. Melt the wax and oil of theobroma with a gentle heat, then add the hydrochlorate of morphia and benzoated lard previously rubbed together in a mortar, and mix all the ingredients thoroughly. Pour the mixture while it is fluid into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository, which will contain half-a-grain of hydrochlorate of morphia.*

TROCHISCI MORPHIÆ—Morphia Lozenges.—*Take of hydrochlorate of morphia,* 20 *grains; tincture of tolu,* ½ *fluid ounce; refined sugar, in powder,* 24 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia, a sufficiency; distilled water,* ½ *fluid ounce. Dissolve the hydrochlorate of morphia in the water; add this solution to the tincture of tolu, previously mixed with two fluid ounces of the mucilage; then add the gum and the sugar, previously mixed, and more mucilage, if necessary, to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat.* Each lozenge contains one thirty-sixth of a grain of hydrochlorate of morphia.

TROCHISCI MORPHIÆ ET IPECACUANHÆ—Morphia and Ipecacuan Lozenges.—*Take of hydrochlorate of morphia,* 20 *grains; ipecacuan, in fine powder,* 60 *grains; tincture of tolu,* ½ *fluid ounce; refined sugar, in powder,* 24 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia, a sufficiency; distilled water,* ½ *fluid ounce. Dissolve the hydrochlorate of morphia in the water: add this solution to the tincture of tolu, previously mixed with two fluid ounces of the mucilage: then add the ipecacuanha, gum, and sugar, previously mixed, and add more mucilage, if necessary, to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat.* Each lozenge contains one thirty-sixth of a grain of hydrochlorate of morphia, and one-twelfth of a grain of ipecacuan.

MORPHIÆ ACETAS—Acetate of Morphia.—($C_{34}H_{19}NO_6, C_4H_3O_3 + HO$ or $C_{17}H_{19}NO_3C_2H_4O_2$). *Take of hydrochlorate of morphia,* 2 *ounces; solution of ammonia, acetic acid, distilled water, of each a sufficiency. Dissolve the hydrochlorate of morphia in one pint of distilled water, and add solution of ammonia until the morphia is precipitated and the liquid rendered slightly alkaline. Collect the precipitate on a filter, wash it with distilled water, then having transferred it to a porcelain dish, add four ounces of distilled water and a sufficient quantity of acetic acid to neutralise and dissolve it. Evaporate the solution by the heat of a water-bath until it concretes on cooling. Lastly, dry the salt with a gentle heat, and reduce it to powder.*

CHARACTERS.—*A white powder, soluble in water and in spirit.*

TESTS.—*From its solution potash throws down a precipitate which is dissolved by excess of the alkali.*[1] *It is affected by nitric acid and perchloride of iron in the same way as hydrochlorate of morphia is.*[2] *When sulphuric acid is added to the salt, acetous vapours are evolved.*[3]

[1] Characteristic of salts of morphia—the morphia being first precipitated and then redissolved. [2] It becomes orange red when moistened with the former and gives a blue solution with the latter. [3] Showing the presence of an acetate.

The acetate is apt to lose a portion of its acetic acid on keeping, and get thereby mixed with pure morphia, which, being exceedingly insoluble, renders it inferior to the hydrochloric, which is stable. Its actions and uses are precisely the same as those of the hydrochlorate. When prescribed in solution it is necessary to add a portion of acetic acid to secure its complete solubility, a precaution which is attended to in the preparation of the Officinal Liquor.

LIQUOR MORPHIÆ ACETATIS — SOLUTION OF ACETATE OF MORPHIA.—*Take of acetate of morphia,* 4 *grains; diluted acetic acid,* 8 *minims; rectified spirit,* 2 *fluid drachms; distilled water,* 6 *fluid drachms. Mix the acid, the spirit, and the water, and dissolve the acetate of morphia in the mixture.*

Dose.—Of hydrochlorate or of acetate of morphia, one-eight to one-half of a grain; *endermically,* from one to two grains; of *liquor morphiæ hydrochloratis,* or of *liquor morphiæ acetatis,* ten to forty minims; of *trochisci morphiæ,* and of *trochisci morphiæ et ipecacuanhæ,* one occasionally, not exceeding ten to fifteen in the day; of *suppositoria morphiæ,* one, either of the officinal strength, or weaker or stronger, as circumstances require. The salts of morphia may also be introduced into the system by inoculation, or by injecting their solutions hypodermically.

Antidotes.—Treatment the same as in poisoning by opium.

The researches of Claude Bernard, Dr J. Harley, and others, into the special properties of the alkaloids of opium have proved that they generally possess a double action, 1*st*, hypnotic, 2*nd*, convulsant. In morphia the hypnotic tendency is the stronger. But whether the stimulant or sedative effect of the drug shall be developed seems to depend greatly on the temperament of the individual to whom it is administered. Morphia and its salts, however, act on the whole like opium and its preparations, but with some exceptional differences, which have neither been well-defined nor universally supported. Referring to what has been said about opium for their general actions, it will be sufficient to enumerate here the chief of the peculiarities which have been observed in the action of the salts of morphia:—1. Morphia does not give rise so frequently to pleasurable feelings and excitement as opium, and

therefore it is less liable to be used by the opium eater, unless it be simply to allay pain. 2. The pupils are usually contracted, but not so unequivocally as in poisoning by opium. 3. Morphia is apt to produce itching of the skin, a cutaneous eruption, difficulty in voiding urine, and, in large doses, great cerebral excitement. 4. On the other hand, it is said that morphia is generally less stimulant than opium, that it is not followed to the same extent by the disagreeable after-effects of nausea, headache, loss of appetite, and debility, and still less so by dryness of the mouth and throat, and constipation, and that the sleep produced by it is less disturbed and more refreshing than that obtained by opium, though much less tranquil and beneficial than ordinary sleep. But the principal advantages to be obtained from the substitution of morphia for opium are derived from its relative bulk and definite strength, as for all practical purposes its effects may be considered identical with those of opium, although it is undoubtedly an available remedy with some persons who cannot tolerate opium. The salts of morphia are especially useful for endermic and hypodermic application, by which methods they have been successful in the treatment of neuralgia, headache, spasms, gastrodynia, chronic vomiting, chronic deafness, &c., by application near to the part affected. They are also given in a variety of cases as substitutes for the preparations of opium, according to the peculiarities of the patient and the object to be attained.

MORPHIÆ SULPHAS.—Sulphate of morphia is met with, to a small extent, in opium. It may be prepared by dissolving morphia in diluted sulphuric acid, and evaporating. It occurs in delicate fasciculi of white acicular crystals, which have a silky lustre, are intensely bitter, are not changed by exposure to the air, and are soluble in water. It may be given in doses of one-eighth to one-quarter of a grain, or in quantity, and in circumstances similar to those mentioned under the hydrochlorate.

CODEIA ($C_{18}H_{19}NO_3$) exists in opium to the extent of one-half to one per cent. It is separated in the process for the preparation of hydrochlorate of morphia, but as it is not precipitated by the ammonia, it remains in the mother liquor, from which it may be obtained by evaporation. It occurs in crystals, which are transparent and colourless, and either acicular or in the form of flat prisms. It is alkaline, forms salts with acids, is soluble in water, alcohol, ether, and dilute acids, and is distinguishable from morphia by not being turned red by nitric acid, nor blue by perchloride of iron, by its insolubility in the fixed alkalies, and by its greater solubility in water and in ether. Codeia agrees very much with morphia in its actions, and like it is possessed of both hypnotic and stimulant powers. According to Bernard's experiments on animals

the effects of codeia differ chiefly from those of morphia in the manner in which the animal wakes up after a dose. From sleep induced by morphia he observed that the dogs on which he experimented woke up in a fright, with the hinder extremities in a condition of semi-paralysis; while from the soporific effects of codeia the dogs would rise quietly, calmly, and composedly, and without exhibiting any paralytic symptoms. As a hypnotic it is much inferior to morphia, while its stimulant properties are more pronounced. A larger dose is also needed, so that therapeutically it is on the whole much inferior to morphia. It is stated, though the grounds are rather unsatisfactory, to produce more refreshing sleep than morphia, without causing its unpleasant effects. It has been recommended in rheumatism, gout, cancer, and other painful diseases, and to allay the distressing cough of phthisis, bronchitis, &c. It may be given in doses of one-half of a grain, cautiously increased to one or two grains, according to circumstances.

THEBAIA OR PARAMORPHIA ($C_{19}H_{21}NO_3$) is an alkaline white crystallisable solid, which forms salts with dilute acids, is soluble in alcohol, in ether, and in dilute acids, but scarcely at all in water, and is precipitated from its solution by the alkalies. It has an acrid, styptic taste, by which, and also by the shortness and want of brilliancy of its crystals, it is distinguishable from narcotine, which it otherwise resembles. Perchloride of iron does not turn it blue. According to the experiments of Magendie, thebaia acts as a powerful poison; one grain, when injected into the jugular vein, or placed in the pleura, having caused symptoms like those produced by strychnia, tetanus and death occurring in a few minutes. The observations of Magendie have been repeated and confirmed by Claude Bernard and Dr J. Harley. Thebaia, therefore, takes the first rank among the convulsant constituents of opium. Its soporific action, though there is reason to know that it possesses such, is very slight indeed. It is the most dangerous of the opium alkaloids, and it would be of considerable advantage were we able to classify the various kinds of opium according to the proportion of thebaia they contained. It is not used medicinally.

NARCOTINE ($C_{22}H_{23}NO_7$) exists in opium in the free state, and may be dissolved out by ether; it may also be obtained by digesting in dilute hydrochloric acid the residue from an aqueous solution of opium, such as is left in the preparation of the extract of opium or the hydrochlorate of morphia. It is neutral to vegetable colours, but forms soluble bitter salts with dilute acids. It occurs as a white, inodorous, and, when pure, insipid substance, crystallising in rhombic prisms, insoluble in cold, and but sparingly soluble in hot water, insoluble in alkalies, readily soluble in ether, alcohol, and in volatile oils. It is not turned blue by perchloride of iron, nor red by nitric acid, which turns it yellow; but sulphuric acid, with a trace of nitric acid, immediately reddens it, whilst sulphuric acid alone turns it yellow. It does not decompose iodic acid. Magendie supposed it to be the stimulant principle in opium, whilst Orfila and Bally maintained that it is inert. The experiments of Claude Bernard prove that it possesses undoubted convulsant properties, while at the same time they show that it is a substance of no great activity. It has recently been recommended as a tonic, febrifuge, and antiperiodic, and has been used with success as a substitute

for quinine in intermittent and remittent fevers. It may be given as a tonic in convalescence from fevers, in doses of one to three grains; as a febrifuge or antiperiodic in doses of five to twenty grains; in the larger doses it acts as a diaphoretic.

NARCEIN ($C_{23}H_{29}NO_9$) occurs in radiating tufts of fine silky acicular crystals, which are white, inodorous, and have a slightly bitter, metallic taste. It is a feeble base, soluble in 400 parts of water at 60°, and in 100 parts of water at 212°: it is less soluble in alcohol, and insoluble in ether and chloroform; soluble in 33 parts of glycerine at 212°, and in 66 parts at 60°. It combines with the diluted acids, forming crystallisable salts. Concentrated sulphuric acid dissolves it, producing an intense red colour, which passes into green when gently heated. Iodine produces a deep blue, which disappears on the addition of an alkali.

Narcein is a pure hypnotic, but much weaker than morphia. It seems to be entirely free from all convulsant action. Dr J. Harley has found that upwards of five grains administered by the mouth are required to induce a slight tendency to sleep; whilst, when introduced subcutaneously, one grain at least is needed to produce the effect of one-eighth of a grain of salt of morphia. He also finds that, if a sufficient quantity is injected below the skin, it is apt to give rise to mechanical suppression of urine, by becoming deposited in and blocking up the tubuli uriniferi. As a hypnotic, however, it does not seem to possess any superiority over morphia. But, according to Claude Bernard, it produces sleep more calm and deep than that induced by morphia or codeia.

CRYPTOPIA ($C_{23}H_{25}NO_5$), an alkaloid discovered a few years ago by Messrs T. & H. Smith, Edinburgh, is colourless, inodorous, and crystallises in hexagonal prisms, or hexagonal plates. Its salts have a taste at first bitter, but afterwards produce a feeling of coolness in the mouth, as if peppermint water had been taken. It has a strong alkaline reaction, neutralising the strongest acids, and forming salts. It forms crystalline salts, which, however, have a remarkable tendency to form a jelly. It is exceedingly insoluble in water, soluble in chloroform, very slightly soluble in ether, which, like water, takes up a mere trace of it. Thebaia is often present as an impurity, but is known by giving a purple with sulphuric acid. If cryptopia is pure, it yields a blue colour. It is distinguished from codeia and thebaia by its insolubility in ether, while its very sparing solubility in alcohol serves to separate it from morphia.

Cryptopia, according to the experiments of Dr J. Harley, like morphia, possesses both hypnotic and convulsant properties. Its hypnotic effects are, however, the far most marked. It is only about one-fourth as active as morphia, and does not seem to possess any advantage over it. In large doses it is found to cause *dilatation* of the pupils.

OPIANINE ($C_{66}H_{72}N_4O_{21}$) is a base which is only found in Egyptian opium. According to Kegler, who discovered it, it is possessed of narcotic properties as active as those of morphia.

PAPAVERINE ($C_{20}H_{21}NO_4$) is a feeble base, insoluble in water, soluble with difficulty in cold alcohol and ether, more readily soluble in other menstrua when warm. Claude Bernard has proved that it possesses convulsive actions almost as pronounced as those of thebaia.

PSEUDO-MORPHINE ($C_{27}H_{36}N_2O_{14}$) would appear not to be poisonous.

Pelletier looked upon it as a modification of morphia, in which the latter had lost its poisonous properties.

MECONINE ($C_{10}H_{10}O_4$) occurs in six-sided prismatic crystals, which are white, inodorous, and at first tasteless, but afterwards somewhat acrid. It is neutral to acids; with sulphuric acid it gives a colourless limpid solution. It is soluble in water, in alcohol, and in ether. It contains no nitrogen. It is not turned blue by perchloride of iron. According to Dr J. Harley, meconine administered *subcutaneously*, in doses of one to two grains in the adult, and one-half grain in children, is simply a tranquillising hypnotic, and is not followed by any of the unpleasant effects which sometimes attend the use of opium and morphia. He therefore recommends it in cases in which opium disagrees, or in which children are threatened with convulsions. According to the same authority, meconine introduced by the stomach is inert, or nearly so.

MECONIC ACID ($H_3C_7HO_7 3H_2O$) is a tribasic acid, occurring, when pure, in white, transparent, micaceous scales. It is soluble to a certain extent in cold water, but more so in hot water, which, at the boiling point, decomposes meconic acid into carbonic acid, which escapes, and comenic or metameconic acid. It is soluble in alcohol, and, by combination with bases, readily forms salts. It may be procured in the process for the preparation of hydrochlorate of morphia by decomposing the meconate of lime by means of hydrochloric acid. Meconic acid and its salts form, with persalts of iron, a compound which has an intensely red colour (meconate of peroxide of iron), resembling that of the sulpho-cyanide of iron, but differing from the latter in not being decolorised by a solution of corrosive sublimate; this is an important test in medico-legal investigation. Added to a solution of the ammonio-sulphate of copper, it gives a green precipitate of meconate of copper. Meconic acid, when taken alone, is probably inert, but doubtless modifies the action of substances with which it may be combined, as in opium.

The *brown acid extractive* is probably a heterogeneous compound, which has not yet been thoroughly examined; it is supposed to be an active principle of opium, and to possess, to a certain extent, its narcotic properties. The *volatile odorous principle* of opium has never been isolated, and its properties are consequently unknown.

Argemone mexicana—Mexican or Gamboge Thistle, or Prickly Poppy—affords seeds which have narcotico-acrid properties, and from which an oil is obtained by expression. This oil is said to possess anodyne, hypnotic, antispasmodic, and purgative properties; it has been recommended in cholera in doses of thirty drops. *Chelidonium majus*—Celandine—yields an orange-coloured juice, which is poisonous in over-doses; but it has been given internally as an aperient, diuretic, and stimulant, and applied externally for the removal of warts, and also in opacities of the cornea. *Sanguinaria canadensis*—Blood-root or Puccoon The root of this plant yields a red juice, whence its name, Blood-root. The root possesses acrid, narcotic, and emetic properties. It acts, when given internally, according to the dose, as an emetic, purgative, arterial sedative, stimulant, diaphoretic, or expectorant. In over-doses it is poisonous. Externally it is a powerful irritant. It has

been given in chronic affections of the lungs, in rheumatism, in chronic hepatic affections, &c.; and applied externally to ill-conditioned ulcers, cancer, certain skin diseases, &c. *Dose* of the powdered root as a sedative, one grain frequently repeated; as a diaphoretic or expectorant, one to five grains; as an emetic, ten to twenty grains in water.

CRUCIFERÆ or BRASSICACEÆ—Cruciferous or Cabbage Order.—Herbaceous, or very rarely shrubby plants, widely distributed, but abounding in cold, temperate climates, especially in Europe. The order is divided into several sub-orders and tribes, either according to the nature of the fruit or the manner in which the embryo is folded. The order contains many useful culinary vegetables, but not one poisonous plant. Many of the plants contain much nitrogen and sulphur, and the seeds frequently yield a fixed oil. The plants generally possess acrid, pungent, and antiscorbutic properties. Officinal plants: *Sinapis nigra, Sinapis alba, Cochlearia Armoracia.*

Sinapis—Mustard.—Officinal plants; *Sinapis nigra,* Linn., and *Sinapis alba,* Linn.; *Tetradynamia Siliquosa;* Black and White Mustard. Illustration, plates 969 and 1677, *Eng. Bot.* Officinal part: The seeds reduced to powder, mixed; cultivated in England. Officinal preparation: *Cataplasma Sinapis, Oleum Sinapis, Linimentum Sinapis Compositum.*

Botany. — Indigenous annuals. *Sinapis nigra.* — *Stem,* smooth, branched, three or four feet in height. *Leaves: lower,* large, lyrate, rough, lobed, and toothed; *upper,* petioled, smooth, narrow-lanceolate, entire. *Inflorescence,* yellow flowers. *Pods,* quadrangular, smooth, pressed to the stem. *Seeds,* numerous, round, shining, dark-brown. *Flowering time,* June and July. *Habitat,* indigenous, waste places and fields; cultivated. *Sinapis alba.—Root,* small and tapering. *Stem,* erect, branched, rough, hirsute, eighteen inches to two feet high. *Leaves,* bright green, lyrate, deeply cut, roughish. *Inflorescence,* large yellow flowers, in terminal spikes or racemes. *Pods,* bristly, short, two-edged, tumid, with long beak. *Seeds,* rather large, not numerous, yellowish-brown. *Flowering time,* July. *Habitat,* indigenous, waste places and corn-fields; cultivated.

Characters of the Powder.—*Greenish-yellow, of an acrid, bitterish, oily, pungent taste, scentless when dry, but exhaling, when moist, a pungent, penetrating, peculiar odour, very irritating to the nostrils and eyes.*

Purity Test.—*A decoction cooled is not made blue by tincture of iodine.*

Wheaten flour, coloured with turmeric, is often added to flour of mustard as an adulteration, the loss of pungency being supplied by capsicum; its presence would be detected by the above test. The best flour of mustard is made by mixing the seeds of the black and white mustard, crushing them between rollers, and afterwards pounding and sifting them. The seeds of black mustard have an acrid, pungent, bitter, and oleaginous taste, which is less powerfully resembled by that of the white seeds.

Active Constituents.—Of Black Mustard Seeds: about 28 per cent. of

a mild, reddish, fixed oil. Myronic acid (in the form of myronate of potash), a non-crystalline acid, bitter and odourless. Myrosin, a substance resembling vegetable albumen and emulsin, but capable of developing the volatile oil of mustard, a property which the others do not possess. Sinapisin, a white, volatile, crystalline substance. A colourless or pale-yellow, pungent, acrid, and burning volatile oil (C_4H_5NS): the volatile oil does not exist in the flour of mustard until water is added, hence the difference mentioned in the officinal characters between the dry and moist farina; it is produced by the action upon each other of myrosin, myronic acid, and water. It is said to be the sulphocyanide of allyl (C_3H_5CNS). *Of White Mustard Seeds:* a mild fixed oil, similar to that of the black seeds. An acrid, oily, fixed principle, which gives to the seeds their biting taste. Myrosin. Hydrosulphocyanate of sinapine. No myronate of potash, nor can the volatile oil be developed in their farina.

CATAPLASMA SINAPIS—MUSTARD POULTICE.—*Take of mustard, in powder,* 2½ *ounces; linseed meal,* 2½ *ounces; boiling water,* 10 *fluid ounces. Mix the linseed meal gradually with the water, and add the mustard, with constant stirring.*

OLEUM SINAPIS—OIL OF MUSTARD.—The oil distilled with water from the seeds of Black Mustard, *Sinapis nigra*, Linn., after the expression of the fixed oil.

CHARACTERS.—*Colourless or pale yellow. Specific gravity,* 1·015. *Dissolves readily in alcohol and ether, and to a slight extent in water. Has an intensely penetrating odour, and a very acrid, burning taste. Applied to the skin, it produces almost instant vesication.*

LINIMENTUM SINAPIS COMPOSITUM—COMPOUND LINIMENT OF MUSTARD.—*Take of oil of mustard,* 1 *fluid drachm; ethereal extract of mezereon,* 40 *grains; camphor,* 120 *grains; castor oil,* 5 *fluid drachms; rectified spirit,* 4 *fluid ounces. Dissolve the extract of mezereon and camphor in the spirit, and add the oil of mustard and castor oil.*

Mustard is largely used as a condiment, and as such promotes digestion. It acts as a stimulant, quickening the circulation, and, when continued, increasing the quantity of urine. In larger doses (one or two teaspoonfuls in a tumblerful of warm water) it acts as a stimulating emetic, producing but little subsequent depression. Externally it acts as an irritant, rubefacient, and derivative, and will readily produce vesication and more serious effects if carelessly applied; hence, when a mustard poultice is applied to a patient who is insensible, it is important to watch its effects from time to time, and above all, not to *forget it.* Mustard has been recommended as a diuretic, in the form of mustard whey, which may be prepared by boiling half-an-ounce of the bruised seeds in a pint of milk and straining, the whole of which may be taken, at intervals, daily. As an emetic it is useful in narcotic poisoning, and in other

lethargic, debilitated, and congested conditions, in which it is of importance to empty the stomach and arouse the vital powers promptly, without causing subsequent depression. Topically, mustard is of great use as a counter-irritant and derivative and stimulant cataplasm in a vast number of cases. Mustard is sometimes added with advantage to a warm bath in the case of children with retrocedent skin eruptions, or suffering from severe bronchitis. A mustard sitz bath is also frequently beneficial in amenorrhœa, while mustard pediluvia are found useful in alleviating headache, diminishing congestion of the head, and lessening inflammation of internal organs. The liniment is vesicating and stimulating, and is used, either alone or diluted with an equal bulk of olive oil or glycerine, to rub over scrofulous glands, over the chest in pleurodynia, for cases of lumbago and sciatica, and in chronic sprains. The objections to its use are, that it is both expensive and liable to deteriorate on keeping through escape of the volatile oil.

Armoraciæ Radix—Horse-radish Root.—Officinal plant: *Cochlearia Armoracia,* Linn.; *Tetradynamia Siliculosa;* Horse-radish. Illustration, plate 150, *Woodv. Med. Bot.* Officinal part: The fresh root; cultivated in Britain. Officinal preparation: *Spiritus Armoraciæ Compositus.*

Botany.—Perennial. *Root,* long, white, cylindrical, pungent (see p. 316, where it is compared with the root of Monkshood). *Stem,* erect, round, branches, about two feet in height. *Leaves:* the radical leaves are large, oblong, crenate, dark green; those of the stem are smaller, sessile, lanceolate. *Inflorescence,* flowers numerous, white, racemose. *Flowering time,* May. *Habitat,* occasionally in waste places; chiefly cultivated.

CHARACTERS.—*A long, cylindrical, fleshy root, half-an-inch to one inch in diameter, expanding at the crown into several very short stems. It is internally white, and has a pungent taste and smell.*

Active Constituents.—Similar to those of the seeds of black mustard, namely, myrosin and myronic acid, which, with the water, produce an exceedingly pungent, powerful, and odorous *volatile oil.* The root is most active in spring and autumn; when carefully preserved in the fresh state, it retains its properties for a considerable time; but it is difficult to dry the root without injuring its active principles.

SPIRITUS ARMORACIÆ COMPOSITUS—COMPOUND SPIRIT OF HORSE-RADISH.—*Take of horse-radish, scraped; bitter-orange peel, cut small and bruised, of each,* 20 *ounces; nutmeg, bruised,* ½ *ounce; proof spirit,* 1 *gallon; water,* 2 *pints. Mix, and distil a gallon with a moderate heat.*

Dose.—One to two fluid drachms as an adjunct to other medicines.

Horse-radish acts much like mustard, as a stimulant, emetic, diuretic, counter-irritant, &c. It is used as a condiment, and pro-

motes digestion. It is not much used as a medicine; the compound spirit may be added, as a stimulant, diuretic, or diaphoretic, to other medicines. It has also been employed as a sialagogue, and was formerly, in common with other cruciferous plants, esteemed as an antiscorbutic.

Cochlearia officinalis—Common Scurvy-grass—as its popular name implies, was formerly held in reputation as an antiscorbutic, but it is no longer employed.

VIOLACEÆ—The Violet Order.—The plants of this order possess emetic and purgative properties, the former being due to the presence of *violin*, which resembles *emetin*. *Viola odorata*—the March or Sweet Violet—the Ion of the Greeks—has given a name both to colour and fragrance; its flowers are employed as a test, the blue-coloured infusion of the petals being turned red by acids and green by alkalies. A syrup of violets is employed as a laxative for young children, and also to give colour and flavour to other medicines; other parts of the plant are emetic and purgative. *Viola canina*, the Dog Violet, has been employed in skin diseases.

POLYGALACEÆ—Milkwort Order.—Herbs or shrubs, widely scattered over the world. The plants are generally bitter and acrid, and have milky roots; some are edible. Medicinally they are expectorant, sudorific, diuretic, purgative, tonic, stimulant, or febrifugal. Officinal plant: *Polygala Senega*.

Senegæ Radix—Senega Root.—Officinal plant: *Polygala Senega*, Linn.; *Diadelphia Octandria*; Snake-root, Rattlesnake Milkwort, Senega, or Seneka Snake-root. Illustration, plate 103, *Steph. and Church. Med. Bot.* Officinal part: The dried root; from North America. Officinal preparations: *Infusum Senegæ*, *Tinctura Senegæ*.

Botany.—Perennial. *Root*, woody, branched, contorted, covered with a thick, dull yellowish or greyish bark. *Stems*, annual, several, erect, slender, round, simple, smooth, dull purple below, greenish towards the top, nine to twelve inches in height. *Leaves*, alternate, nearly or quite sessile, lanceolate, pointed, smooth. *Inflorescence*, loose terminal spikes; flowers white, often tinged with purple. *Flowering time*, June to August. *Habitat*, hill sides and dry woods in the United States, especially in the Southern and Western States.

CHARACTERS.—*A knobby root-stock, with a branched tap-root, of about the thickness of a quill, twisted and keeled; bark yellowish-brown, sweetish, afterwards pungent, causing salivation; interior woody, tasteless, inert.*

Active Constituents.—Polygalic acid or senegin, virgineic acid, tannic acid, pectin, &c. Polygalic acid is obtained from the cortical part of the root; when pure it is a white powder, inodorous, and at first tasteless, but afterwards intensely acrid, causing an unpleasant feeling of constriction of the fauces. Eight-grain doses caused the death of dogs in three hours.

INFUSUM SENEGÆ—Infusion of Senega.—*Take of senega root, bruised,* $\frac{1}{2}$ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain.*

TINCTURA SENEGÆ—Tincture of Senega.—*Take of senega root, in coarse powder,* $2\frac{1}{2}$ *ounces; proof spirit,* 1 *pint. Macerate the senega for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of the powdered root, ten to thirty grains; of the infusion, half a fluid ounce to two fluid ounces; of the tincture, half a fluid drachm to two fluid drachms, added to the infusion or other expectorant mixture.

Senega acts as a stimulating expectorant, diuretic, diaphoretic, and emmenagogue, when administered in small doses; in larger doses it operates as an emetic or purgative, and is apt to produce troublesome salivation. It was formerly employed as an antidote to the bites of snakes. It is chiefly used in chronic bronchial and pulmonary inflammations, in cases which require stimulation rather than depletion. It may be combined with ammonia, squill, &c., or, in more acute cases, with tartar emetic. It has also been recommended in croup, whooping-cough, dropsies, amenorrhœa, dysmenorrhœa, &c.

KRAMERIACEÆ—The Rhatany Order.—This order possesses but one genus, *Krameria*, differing from the *Polygalaceæ*, and that only in minor points. The genus is distributed over the warm and temperate regions of Central and South America, and the species are characterised by their astringent roots. Officinal plant: *Krameria triandra.*

Krameriæ Radix—Rhatany Root.—Officinal plant: *Krameria ritandra, Ruiz and Pavon, Flor. Peruv.; TriandriaMonogynia;* Peruvian or Payta Rhatany. Illustration, plate 72, *Steph. and Church. Med. Bot.* Officinal part: The root dried; imported from Peru. Officinal preparations: *Extractum Krameriæ, Infusum Krameriæ, Tinctura Krameriæ;* it enters also into *Pulvis Catechu Compositus.*

Botany.—Under-shrub. *Root,* long, much branched, spreading. *Stem,* procumbent, round, branched. *Leaves,* white and silky on both surfaces, alternate sessile, entire, oblong-ovate. *Inflorescence,* terminal, solitary; flowers lake-coloured, on short foot-stalks. *Fruit,* globular, drupaceous. *Flowering time,* chiefly in October and November, but nearly throughout the year. *Habitat,* the declivities of mountains, exposed to a vertical sun, in Peru and Bolivia.

Characters of the Root.—*About an inch in diameter, branches numerous, long, brownish-red and rough externally, reddish-yellow internally, strongly astringent, tinging the saliva red.*

Active Constituents.—Krameric acid and tannic acid, with a small quantity of gallic acid.

EXTRACTUM KRAMERIÆ—Extract of Rhatany—*Take of rhatany root, in coarse powder,* 1 *pound; distilled water, a sufficiency. Macerate the rhatany in a pint and a half of the water for twenty-four hours; then pack in a percolator, and add more distilled water, until twelve pints have been collected, or the rhatany is exhausted. Evaporate the liquor by a water-bath to dryness.*

INFUSUM KRAMERIÆ—Infusion of Rhatany.—*Take of rhatany root, bruised,* ½ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain.*

TINCTURA KRAMERIÆ—Tincture of Rhatany.—*Take of rhatany root, in coarse powder,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the rhatany root for forty-eight hours, in fifteen ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of the spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of the powdered root, ten to thirty grains; of the extract, five to twenty grains; of the infusion, one to two fluid ounces; of the tincture, one to two fluid drachms.

Rhatany acts as a pure and powerful astringent, and as a tonic. It is employed to check excessive mucous secretions, passive hemorrhages, &c., and is useful in diarrhœa, dysentery, hæmaturia, passive hemorrhage from the bowels, menorrhagia, as a gargle in relaxed sore-throat, internally and as an injection in leucorrhœa, as an astringent application to the mucous membrane of the nose, eyes, gums, &c. Externally, it is applied to discharging ulcers, to arrest hemorrhage from small vessels, &c.

MALVACEÆ—The Mallow Order.—Herbs, shrubs, or trees, inhabiting tropical, and the warmer parts of temperate, regions. The plants are generally mucilaginous and demulcent, and are not deleterious.

GOSSYPIUM—Cotton Wool.—The hairs of the seed of various species of Gossypium, *Linn.*, carded. Cotton Wool is prepared by carding the hairs of the seeds of various species of the genus *Gossypium.* The cotton of commerce, which, in its unprepared state, is termed *raw cotton,* is produced by probably four distinct species, namely, *Gossypium herbaceum,* the common cotton plant of India; *G. barbadense,* which supplies the best cotton, including Bourbon cotton, Sea Island cotton, New Orleans and Georgian cotton; *G. peruvianum* or *acuminatum,* which supplies Pernambuco, Peruvian, Brazilian cotton, &c.; and *G. arboreum,* the Tree-cotton of India, which supplies a fine silky cotton.

Each filament, the mass of which constitutes cotton wool, in the recent state is tubular, but becomes flattened on drying. Under the microscope they present the appearance of long, narrow, flattened ribbons, with occasional joints, indicated by lines passing across them at nearly right angles to the margin. In this they differ from linen, the fibres of which have tapering extremities, and their joints are oblique. Cotton is a modification of lignin, and in its chemical properties resembles woody fibre. Cotton is employed as an application to blistered surfaces, and to burns; it is applied in thin layers firmly and evenly to the part; and as the object is to form with the secretions an impenetrable covering, which is for a time to supply the protection previously provided by the cuticle, it should be as little disturbed as possible. A spirituous or turpentine lotion is sometimes applied to extensive burns previous to covering the parts with cotton. The outer layers, for cleanliness, may be occasionally removed, but the layer in contact with the wound should be allowed to remain undisturbed for several days.

Pyroxylin—Gun Cotton.—The composition of this substance varies with the method of its preparation, and there are at least four varieties of it. It is in all cases regarded as the nitrite of an organic base, and the formula of the officinal variety is probably $C_{18}\left.\begin{matrix}H_{22}\\ 8NO_2\end{matrix}\right\}O_{15}$

Preparation.—*Take of cotton,* 1 *ounce; sulphuric acid, nitric acid, of each,* 5 *fluid ounces. Mix the acids in a porcelain mortar, immerse the cotton in the mixture, and stir it for three minutes with a glass rod, until it is thoroughly wetted by the acids. Transfer the cotton to a vessel containing water, stir it well with a glass rod, decant the liquid, pour more water upon the mass, agitate again, and repeat the affusion, agitation, and decantation, until the washing ceases to give a precipitate with chloride of barium. Drain the product on filtering paper, and dry in a water-bath.*

Purity Test.—*Readily soluble*[1] *in a mixture of ether and rectified spirit; leaves no residue when exploded by heat.*

[1] In order to render it entirely soluble, the specific gravity of the nitric acid should not exceed 1·420. Gun cotton resembles ordinary cotton in appearance; but it is more brittle, highly electric and explosive, and leaves no residue after combustion. Its only medicinal use is in the preparation of collodion.

Collodium—Collodion.—*Pyroxylin,* $C_{18}\left.\begin{matrix}H_{22}\\ 8NO_2\end{matrix}\right\}O_{15}$, *dissolved in ether mixed with one-third of its volume of rectified spirit.*

Preparation.—*Take of pyroxylin,* 1 *ounce; ether,* 36 *fluid ounces; rectified spirit,* 12 *fluid ounces. Mix the ether and the spirit, and add the pyroxylin. Set aside for a few days, and, should there be any sediment, decant the clear solution. Keep it in a well-corked bottle.*

Characters.—*A colourless highly inflammable liquid, with ethereal odour, which dries rapidly upon exposure to the air, and leaves a thin transparent film, insoluble in water or rectified spirit.*

COLLODIUM FLEXILE—Flexible Collodion.—*Take of collodion 6 fluid ounces; Canada balsam,* 120 *grains; castor oil,* 1 *fluid drachm. Mix, and keep in a well-corked bottle.*

It is of syrupy consistence. When applied to the skin, it immediately dries and contracts, forming a thin transparent protective covering. The rapidity with which it dries is apt to make it crack and curl up, leaving part of the surface it is intended to protect bare, and to obviate this tendency the Collodium Flexile has been introduced. Three hundred parts of collodion, twelve of Venice turpentine, and six of castor oil, make also a very pliable collodion (Squire). Castor oil alone, or glycerine, may be added for the same purpose. Collodion is employed to form a protective covering to inflamed surfaces, sores, chaps, skin diseases, burns, &c.; it is also used to protect and to promote the adhesion of simple incised wounds, to prevent pitting in smallpox, to arrest hemorrhage from trifling superficial wounds and leech bites, as a stopping to decayed teeth, &c. Pills are sometimes coated with collodion.

ALTHÆA OFFICINALIS—Common Marsh-Mallow; *Monadelphia Polyandria.*—Perennial. *Root,* spindle-shaped and somewhat woody. *Stem,* annual, erect, round, smooth, simple, branched towards the top, two or three feet in height. *Leaves,* alternate, ovate or heart-shaped, pubescent on both sides, feel smooth and velvety. *Inflorescence,* dense axillary panicles, flowers pale rose-coloured. *Flowering time,* July to September. *Habitat,* indigenous, marshes near the sea. The leaves and roots of the plant are mucilaginous, and are employed either as demulcents in the form of decoction or syrup, or as emollients in the form of poultice or fomentation. As a demulcent, the decoction and syrup are employed in inflammatory affections of the air passages, of the alimentary canal, or of the urinary mucous membrane: externally, as a poultice or fomentation, it is applied to acute inflammatory affections, to certain diseases which have an irritating discharge, to ulcers, abraded surfaces, &c. *Pâte de guimauve,* made with mucilage of althæa, gum arabic, sugar, and white of egg, is much used as a pectoral medicine in France.

MALVA—*Malva sylvestris*—Common Mallow: *Monadelphia Polyandria*—*Root,* perennial, tapering. *Stem,* erect, branched, two to four feet high. *Leaves,* on long petioles, with five to seven deep crenate lobes. *Inflorescence,* axillary, flowers numerous, purplish-red. *Flowering time,* June to September. *Habitat,* indigenous, hedges and roadsides. The plant contains a large quantity of tasteless mucilage, upon which depends its demulcent property. It may be used both internally and externally, either as a demulcent infusion or decoction, or as an emollient poultice or fomentation. The entire plant is used.

BYTTNERIACEÆ—the Chocolate Order—consists of trees, shrubs, and under-shrubs, inhabiting tropical and sub-tropical regions. In their properties the plants of this order resemble those of the mallow and silk-cotton orders. *Theobroma Cacao*—the cacao or cocoa tree—is the most important plant of the order. It is a small tree, which abounds in the forests of Demerara and Mexico, and is largely cultivated in the West Indies and elsewhere. From the trunk and branches of the tree

hang large oval yellow capsules, each of which is divided into five cells, and each cell contains from eight to ten ovoid seeds. From these seeds, beans, or nibs, of which there are several varieties, more or less esteemed, the substances called cacao or cocoa and chocolate are manufactured. Cocoa is prepared either by grinding to powder the roasted seeds with their outer shells or husks, or the husks alone, or else by first divesting the seeds of their husks, and then breaking them into small pieces, which are called *cocoa nibs,* the purest cocoa being produced by the latter method. Chocolate is prepared by first divesting the seeds of their husks, then roasting and grinding them, and finally triturating them in a mortar, with sugar to sweeten, with vanilla and cinnamon to flavour, and with arnatto to colour them. The active principle of cocoa-seed is *theobromine,* which resembles theine. The seeds also contain about half their weight of a fatty substance called butter of cocoa or cacao-butter; and it is from the cake which remains after the expression of this fatty oil, that much of the inferior cocoa and chocolate are made. Besides, much of the inferior qualities of these substances is mixed with peas, maize, potato-flour, and other adulterations, which are rendered tenacious by the addition of treacle, mutton-suet, &c. The name Theobroma, signifying food for the gods, was given to the tree by Linnæus, as a suitable expression of his opinion with respect to the qualities of the substances made from its fruit. Cocoa and chocolate are much used as beverages by persons who cannot take tea or coffee, the former being less stimulating than the latter; but from the oily nature of the seeds from which they are prepared, and in consequence of the unwholesome substances with which they are too frequently adulterated, cocoa and chocolate are often found to disagree with persons of weak digestion. Much, however, depends upon the mode of the preparation of cocoa for immediate use. If it is boiled, the concrete oil is separated from the rest of the constituents of the beverage, and in its isolated condition is found to be exceedingly indigestible. But if this is prevented by simply pouring boiling water or milk over it, and stirring, cocoa will seldom disagree with even the tenderest stomach.

OLEUM THEOBROMÆ—Oil of Theobroma. *Synonym:* Cacao Butter.

A concrete oil obtained by expression and heat from the ground seeds of Theobroma Cacao, Linn.

CHARACTERS.—*Of the consistency of tallow; colour yellowish; odour resembling that of chocolate; taste bland and agreeable. Fracture clean, presenting no appearance of foreign matter. Does not become rancid from exposure to the air. Melts at a temperature of* 122°.

Cacao butter softens, without quite fusing, at the temperature of the body, and has no irritating properties.

It is used in the preparation of suppositories, pessaries, ointments, soaps, &c., and also as an application to chapped lips and hands. It has been recommended internally as a substitute for cod-liver oil in cases in which the objections to the latter are insuperable.

DIPTERACEÆ—The Sumatra Camphor Order—consists of large trees with resinous juice, inhabiting Tropical India. *Dipterocarpus turbinatus,* and other species, yield an oleo-resinous substance called Gurjun Balsam or Wood Oil, which is obtained by incisions into the bark of the tree, and which yields, by distillation, an essential oil resembling copaiba. The essential oil, in doses of five to fifteen minims, alone, or in combination with essential oil of copaiba and spirit of nitric ether, is used in gonorrhœa. *Dryabalanops aromatica* or *Camphora,* is a tree from 100 to 130 feet high, and 7 to 10 feet in diameter at the base, a native of Sumatra and Borneo. From the stem of this tree are obtained a liquid termed Liquid Camphor or Camphor Oil, and a solid crystalline substance called Sumatra or Borneo Camphor. The liquid camphor or camphor oil is obtained by incising the tree with an axe, from which openings the oil gushes forth into bamboes or other apparatus prepared to receive it. It is a hydro-carbon, is usually of a yellow-brown colour, and is said to possess the mingled odour of cajeput oil, camphor, and cardamoms; occasionally it is met with transparent, colourless, and quite limpid. Sumatra or Borneo camphor is found concreted in the fissures of the tree, and in order to obtain it the tree is sacrificed. Being cut down, it is split into small pieces, each of which is carefully searched for the crystalline substance. The camphor thus obtained is collected and carefully packed in boxes. Occasionally large masses, weighing as much as ten or twelve pounds, have been obtained, but usually it is in small pieces, which are light, transparent, and brittle, having a hot taste, and the odour of camphor. It is not an article of European commerce, simply because, being highly prized by the Chinese, they purchase it at enormous prices, giving for it even as much as seventy to one hundred times more than for Japan camphor. Borneo camphor acts probably in precisely the same manner as the ordinary Laurel camphor of commerce, but is too expensive for ordinary use.

TERNSTRŒMIACEÆ — The Tea Order — consists of trees or shrubs, inhabiting the East Indies, China, South and North America. The plants generally possess stimulating, slightly narcotic, sedative, astringent, and indirectly nutritive properties. *Thea* is the genus from the leaves of two or more of whose species or varieties the teas of commerce are obtained. In China there are two native tea plants, which are either distinct species, or else merely modifications of the same, the difference depending upon soil, climate, and cultivation. It was formerly supposed that the black and green teas were severally produced by these two varieties, namely, the black teas by the *Thea Bohea,* and the green teas by the *Thea viridis;* but it is now generally understood that both varieties may be obtained from either of these plants, the difference depending, not upon the source of the leaves, but upon the manner in which they are treated. The quality of the tea, however, depends greatly upon the plant itself, the mode of its cultivation, and the climate and soil in which it grows. *Thea viridis* is the only plant cultivated in the north of China, and it supplies the best kind, both of black and green. *Thea Bohea* also affords black and green tea, and is chiefly cultivated in the neighbourhood of Canton. Tea is also now successfully cultivated in certain districts of the Himalayas. *Thea*

Assamica furnishes Assam tea, derived from the province of Assam, where there are now a great number of plantations which produce an excellent quality of tea. The black teas of commerce are known by the names of Pekoe, Lapsang, Congou, Souchong, Bohea, Caper, &c.; and the green teas by the names of Imperial, Gunpowder, Hyson, Hyson Skin, Young Hyson, Twankay, &c. The differences between black and green tea depend chiefly upon the period at which the leaves are gathered and the treatment which they subsequently undergo. Green teas are prepared from the young leaves, which are dried as quickly as possible after they are gathered, then heated slightly, and finally rolled, either separately or in small heaps, and again promptly dried. Black teas are prepared from the older and larger leaves, which are exposed to the air for some time after they are gathered; they are then placed in heaps and allowed to undergo a kind of fermentation, after which they are partially dried by exposure to a fire, then rolled in masses, whereby the leaves are twisted as we see them, and finally, they are slowly dried by the aid of a fire. Thus prepared, the green teas preserve their colour, which the black teas lose; but teas are often dyed green by a preparation consisting of Prussian blue, sulphate of lime, and turmeric, or by a mixture of indigo and sulphate of lime, and, moreover, they are subject to extensive adulteration. Teas are sometimes perfumed by mixing with them the powder of the dried flowers of *Olea fragrans*, the sweet-scented olive, the flowers of *Aglaia odorata, Chloranthus inconspicuus*, &c.

The active constituents of tea are Theine, Volatile Oil, and Tannin. Theine is an azotised salifiable base, and may be obtained in white silky acicular crystals, which are soluble in boiling water, and, to a small extent, in cold water, and in alcohol. Theine, or a substance very closely resembling it, is met with in several other plants which are extensively employed in the preparation of wholesome beverages: as *caffeine*, it is met with in coffee; as *guaranine*, in the leaves of *Guarana officinalis* or *Paullinia sorbilis;* it resembles the *theobromine* of *Theobroma Cacao;* and is said to be met with in *Ilex paraguayensis*, or Paraguay tea. Tea is largely used as an agreeable, refreshing, and indirectly nutritive beverage; it is also employed medicinally as an antidote in poisoning by certain alkaloids, with the view of forming insoluble tannates, and also to counteract the poisonous effects of opium and intoxicating liquors. It has been given in fever to relieve stupor, and, as a sedative of the vascular system, it has been recommended in feverish and inflammatory diseases. It is often resorted to in order to diminish the tendency to sleep by those who are occasionally called upon to study or to watch during the night. It acts upon the nervous system somewhat as an excitant, producing cheerfulness and lightness of the spirits, clearness and quickness of thought, and refreshment after fatigue. It is also astringent. Tea sometimes causes unpleasant effects, as dyspepsia, functional disorder of the heart, &c. As an article of diet Dr Edward Smith gives the following summary:—*Tea is useful* to the corpulent, the over-fed, after a full meal; at the end of the day, when the food has accumulated in the system, when digestion and other vital changes proceed slowly; for the old, for hot climates; for the sedentary, for those who do not perspire freely; for those who eat much starchy food; for soldiers on the march in hot climates, and as a restorative in cases of

drowning, or wherever it is desired to increase the respiratory functions. *Tea is hurtful* in the absence of food, after a long fast (as at breakfast) to the poor and ill-fed, the spare, and the young. It is not adapted to sustain exertion, to prison dietaries, to low temperatures, or to hot climates when the appetite is defective and the skin active, or to those who perspire too freely, neither should it be taken with our principal meal.

AURANTIACEÆ—The Orange Order.—Trees or shrubs, chiefly East Indian plants, but distributed by the agency of man throughout the warmer regions of the globe. The pulp of the fruit has an acid and saccharine taste, the leaves and rind contain a volatile, fragrant oil, which is used in flavouring, in perfumery, and for other purposes. The rind also contains a tonic principle. Officinal plants : *Citrus Bigaradia, Citrus Aurantium, Citrus Limonum, Ægle Marmelos.*

CITRUS.—The genus Citrus is divided into several species and varieties, whose fruits are highly esteemed, and are used as dessert, and for other purposes. The chief varieties are, *Citrus Aurantium*, the sweet orange ; *Citrus Bigaradia* (or *C. vulgaris*), the bitter or Seville orange ; *Citrus Limonum*, the lemon ; *Citrus Limetta*, the lime ; *Citrus Decumana*, the shaddock ; *Citrus Pompelmos*, the pompelmoose ; *Citrus Paradisi*, the forbidden fruit ; *Citrus Olivæformis* (*C. japonica*), the Kumquat of China ; *Citrus Medica*, the citron.

Citrus Bigaradia of Risso (*C. vulgaris*) — the Bitter or Seville Orange ; *Polyadelphia Polyandria.* Illustration, *Risso et Poiteau, Hist. Nat. des Oranges*, plate 30. *Citrus Aurantium, Risso*, the Common or Sweet Orange ; *Polyadelphia Polyandria.* Illustration, *Risso et Poiteau*, plates 3 and 4. Officinal parts :—1. *Cortex Aurantii*, Bitter Orange Peel. The outer part of the rind, dried ; from the ripe fruit imported from the south of Europe. 2. *Aqua Aurantii Floris*, Orange-Flower Water. The distilled water of the flowers, prepared mostly in France. Officinal preparations : *Aqua Aurantii Floris, Infusum Aurantii, Infusum Aurantii Compositum, Syrupus Aurantii, Syrupus Aurantii Floris, Tinctura Aurantii, Vinum Aurantii.* It enters into the composition of *Tinctura Chinchonæ Composita*, and of *Spiritus Armoraciæ Compositus.*

Botany.—An evergreen, much-branched tree, from sixteen to twenty feet in height, covered with a smooth greenish-brown bark. It is remarkable for having the flowers and fruit at all stages at the same time. *Citrus Bigaradia* is rather smaller than the sweet orange tree. Its branches are spiny, its leaves elliptical, acute, or acuminate and slightly toothed, its petiole more or less winged. Its flowers are large, white, and more fragrant than those of the sweet orange. Its fruit is of a dark orange colour, roundish, somewhat elongated or depressed ; its pulp and rind are acid and bitter, the latter having concave receptacles of oil. *Habitat*, Asia ; cultivated in Europe. *Citrus Aurantium* has coriaceous, ovate-oblong, acute leaves, which are commonly finely toothed at the margins ; petioles margined, sometimes winged. Its fruit is globose, with a thin rind, convex oil vesicles, and sweet pulp. Naturalised in Europe.

Oranges are imported from the Azores, Lisbon, Malta, and Sicily ; the

chief varieties are Common Orange, Blood Red, Maltese, St Michael's, and the Chinese or Mandarin. Two other varieties are sometimes imported,—the Navel and Tangerine oranges. The small unripe fruits, both of the bitter and sweet kinds, are known as orangettes, orange-berries, or Curaçoa oranges; they are used for flavouring curaçoa, and also, when polished, as issue peas.

Aurantii Cortex—BITTER-ORANGE PEEL.—Citrus Bigaradia, Risso, *Hist. Nat. des Orang.*, plate 30. The outer part of the rind, dried from the ripe fruit imported from the south of Europe.

CHARACTERS.—*Thin, of a dark orange colour, nearly free from the white inner part of the rind; having an aromatic bitter taste, and fragrant odour.* (The rind of the sweet orange, when mixed with that of the bitter kind, may be detected by its being less bitter, and having convex oil vesicles).

Aqua Aurantii Floris—ORANGE-FLOWER WATER.—Citrus Bigaradia, Risso, *Hist. des Orang.*, plate 30, the Bitter-Orange Tree; and Citrus Aurantium, Risso, plates 3, 4, the Sweet-Orange Tree.—The distilled water of the flowers, prepared mostly in France.

CHARACTERS.—*Nearly colourless, fragrant.* TEST.—*Not coloured by sulphuretted hydrogen.* (Indicating the absence of metallic impurities, particularly lead).

INFUSUM AURANTII—INFUSION OF ORANGE PEEL.—*Take of bitter-orange peel, cut small,* ½ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for fifteen minutes, and strain.*

INFUSUM AURANTII COMPOSITUM—COMPOUND INFUSION OF ORANGE PEEL.

PREPARATION.—*Take of bitter-orange peel, cut small,* ¼ *ounce; fresh lemon peel, cut small,* 60 *grains; cloves, bruised,* 30 *grains; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for a quarter-of-an-hour, and strain.*

An excellent stomachic. It is commonly given as a vehicle for other medicines, such as bitter tinctures and saline purgatives, &c.

SYRUPUS AURANTII—SYRUP OF ORANGE PEEL.—*Take of tincture of orange-peel,* 1 *fluid ounce; syrup,* 7 *fluid ounces. Mix.*

SYRUPUS AURANTII FLORIS—SYRUP OF ORANGE FLOWER.—*Take of orange-flower water,* 8 *fluid ounces; refined sugar,* 3 *pounds; distilled water,* 16 *fluid ounces, or a sufficiency. Dissolve the sugar in the distilled water by means of heat; strain, and when nearly cold add the orange-flower water, with a sufficient quantity of distilled water, if necessary, to make the product four pounds and a-half. The specific gravity should be* 1·330.

TINCTURA AURANTII—TINCTURE OF ORANGE PEEL.—*Take of bitter-orange peel, cut small and bruised,* 2 *ounces; proof spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, and filter, and add sufficient proof spirit to make one pint.*

This tincture is used in the formation of *Mistura Ferri Aromatica, Syrupus Aurantii*, and *Tinctura Quiniæ.*

VINUM AURANTII—Orange Wine.—Wine made in Britain, by the fermentation of a saccharine solution to which the fresh peel of the bitter orange has been added.

Characters.—*A vinous liquid, having a golden sherry colour, and a taste and aroma derived from the bitter-orange peel.*

Tests.—*It contains about* 12 *per cent. of alcohol, and is but slightly acid to test paper.*

An agreeable excipient for various bitter medicines, the only objection to its use being its liability to decompose. It is employed in the preparation of Vinum Quiniæ, and of Vinum Citratis Ferri.

Dose.—Of either of the infusions one to two fluid ounces; of either of the syrups, one to two fluid drachms; of the tincture, half a fluid drachm to two fluid drachms; of the wine, two fluid drachms to half-an-ounce and upwards; of the orange-flower water, one to two fluid ounces.

Orange peel and its preparations are commonly employed as aromatic, tonic, and stomachic, or flavouring adjuncts to, or vehicles for, other remedies. The fruit of the sweet orange is largely used as a dessert, and the pulp and rind of the bitter orange as a confection termed marmalade. From the leaves of both varieties, by distillation with water, is obtained a volatile oil termed *Oil of orange-leaf*, or *Essence de petit grain;* from the flowers of both varieties is obtained a volatile oil termed *Oil of orange flowers*, or *Oil of Neroli;* and from the rind also of both varieties is obtained, by expression, a volatile oil, termed *Oil of orange* or *Oil of Portugal.* In all cases the oil obtained from the bitter orange is the more esteemed variety. They and their distilled waters are stimulant and anti-spasmodic. Orange flower water, added to preparations of iron, is often beneficial in enabling anæmic patients to bear them, whereas they cannot take chalybeate preparations administered alone, on account of their too great stimulant action. Orange juice, either directly from the fruit, or diluted with water and sweetened with sugar, is given as a refrigerant in febrile and inflammatory cases.

Limones—Lemons.—Officinal plant: *Citrus Limonum*, D.C.; *Polyadelphia Polyandria;* the Lemon. Illustration, plate 92, *Steph. and Church. Med. Bot.* (*Citrus Medica*). Officinal parts:—1. *Cortex Limonis,* Lemon Peel. The fresh outer part of the rind of the ripe fruit imported from Southern Europe. 2. *Oleum Limonis,* Oil of Lemon. The oil expressed or distilled from fresh lemon peel; imported chiefly from Sicily. 3. *Succus Limonis,* Lemon Juice. The expressed juice of the ripe fruit. Officinal preparations: Of the peel, *Syrupus Limonis, Tinctura Limonis;* it enters also into the composition of *Infusum Aurantii*

Compositum, and *Infusum Gentianæ Compositum;* of the oil, *Spiritus Ammoniæ Aromaticus,* and *Linimentum Potassii Iodidi cum Sapone;* of the juice, *Syrupus Limonis, Acidum citricum.*

Botany.—A shrub, ten to fifteen feet in height, much branched, with stiff thorns. *Leaves,* oval or oblong-oval, serrulate, or somewhat dentate; petiole simply margined, or with a narrow leafy border. *Flowers,* white, tinged with red. *Fruit,* light yellow when quite ripe; ovoid, with a more or less nipple-shaped nob at the apex; the rind adheres closely to the pulp, and has numerous convex receptacles of oil; pulp acid. *Habitat,* Asia; cultivated in the south of Europe.

Limonis Cortex—Lemon Peel. CHARACTERS.—*In thin slices of a yellow colour, dotted with numerous vesicles of oil, with a fragrant odour, and aromatic, slightly bitter taste.*

Limonis Oleum—Oil of Lemon. CHARACTERS.—*Colour pale yellow, odour agreeable, taste warm and bitter.*

The finer variety of oil is obtained by simple expression. When quite pure it is nearly colourless and limpid; but when exposed to the air it is prone to change, absorbing oxygen, and acquiring a terebinthinate odour. It is isomeric with oil of turpentine, its composition being $C_{10}H_{16}$. It consists of two isomeric oils (*citrene* and *citrelene*), which may be partially separated by distillation. Its specific gravity is about 0·847. It is soluble in anhydrous alcohol, and to a less extent in rectified spirit. It is apt to be fraudulently adulterated with oil of turpentine, a sophistication which is not easily detected when in small quantity.

Limonis Succus—LEMON JUICE. CHARACTERS.—*A slightly turbid yellowish liquor, possessing a sharp acid taste, and grateful odour. Average specific gravity* 1·039. *Average quantity of citric acid in one fluid ounce,* 32.5 *grains.*

Lemon juice is expressed from the pulp after the removal of the rind and seeds, and after standing for a day or two in a cool place, it is decanted and filtered. It contains citric acid, malic acid, mucilage, salts, bitter extractive, and water. It is prone to decomposition when exposed to the air, but may be preserved for a long time, either by keeping it in full and well-corked bottles, or by covering it with a layer of oil; it may also be preserved by the addition of one-tenth part of spirit of wine; one-tenth of strong brandy being added to that which supplies the navy. In all cases the mucilage must be removed as much as possible by filtration, and it must afterwards be kept secluded from the air. Factitious lemon juice is sometimes prepared from citric acid, with the addition of a little oil of lemon.

SYRUPUS LIMONIS—SYRUP OF LEMONS.—*Take of fresh lemon peel,* 2 *ounces; lemon juice, strained,* 1 *pint; refined sugar,* $2\frac{1}{4}$ *pounds. Heat the lemon juice to the boiling point, and, having put it into a covered vessel with the lemon peel, let them stand until they are cold, then filter and dissolve the sugar in the filtered liquid with a gentle heat. The product should weigh three pounds and a half, and should have the specific gravity* 1·34.

TINCTURA LIMONIS—Tincture of Lemon Peel.—*Take of fresh lemon peel, sliced thin,* $2\frac{1}{2}$ *ounces; proof spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, and filter; then add sufficient proof spirit to make one pint.*

Dose.—Of the juice, two fluid drachms to a fluid ounce or more; in rheumatism and scurvy, four or more ounces daily; of the syrup, one, two, or more fluid drachms; of the tincture, half a fluid drachm to two fluid drachms; of the oil, one to five minims. *Lemonade.*—Slice two lemons, add two ounces of sugar, pour over them a pint of hot water, and when cool, strain; dose, *ad libitum. Aerated* or *Effervescing Lemonade* is made by adding lemon syrup to water, and charging it with five times its volume of carbonic acid gas. *Effervescing Draughts* may be made in the following proportion: to half an ounce of lemon juice (equal to seventeen grains of citric acid), carbonate of soda, thirty-five grains; carbonate of potash, twenty grains; carbonate of ammonia, fifteen grains; bicarbonate of soda, twenty grains; bicarbonate of potash, twenty-five grains.

Lemon peel and the preparations made from it are employed as adjuncts to other medicines, affording an agreeable flavour and a somewhat aromatic, tonic, and stomachic effect. Oil of lemons is seldom used internally, except as it enters into aromatic spirit of ammonia; it acts as a stimulant and carminative. Externally it acts as a stimulant and rubefacient. Lemon juice is classed with refrigerants, sedatives, antiscorbutics, and antidotes. Oil of lemons has been employed as a topical stimulant application to the eye in rheumatic and scrofulous ophthalmia, and it may be taken internally as a carminative, in doses of two or three drops, either added to other medicines or dropped upon sugar. It is sometimes added as a perfume to ointments. Lemon juice has been given in the form of a drink, as a sedative and refrigerant, in febrile and inflammatory diseases. In acute rheumatism, and also in gout, it has been recommended. In the form of effervescing lemonade, or an effervescing draught, it is given to allay vomiting. It is given as an antiscorbutic, a daily allowance to sailors on a long voyage being compulsory. It is given as an antidote in narcotic poisoning, and in poisoning with caustic alcalies. It has also been given in acute dysentery and diarrhœa, in dropsical affections, &c.

Citrus Limetta produces the lime, the juice of which is often added to or used as a substitute for lemon juice. *Citrus Bergamia* produces the Bergamot orange, from the rind of which, either by expression or distillation, is obtained a volatile oil, known as Oil of Bergamot. It has a pungent taste and a fragrant odour, and is chiefly used as a perfume, being occasionally added to ointments to render them agreeable. *Citrus Medica* produces the citron, the rind, juice, and volatile oil of which may be used in the same manner as those of the lemon and the lime,

but they are less esteemed. The preserved rind of all these fruits is used in confectionery.

Belæ Fructus—Bael Fruit.—Officinal plant: *Ægle marmelos,* DC.; *Polyandria Monogynia;* the Indian Bael Tree. Illustration, *Pharm. Jour.*, vol. x., plate, p. 166. Officinal part: The half-ripe fruit, dried; from Malabar and Coromandel. Officinal preparation: *Extractum Belæ Liquidum.*

Botany.—A large erect tree, with ash-coloured bark, few and irregular branches, and strong, sharp, axillary thorns. *Leaves,* ternate; leaflets oblong, crenulated. *Flowers,* white and large, in small terminal panicles. *Fruit,* baccate, spheroidal, large, with a hard, smooth rind, ten to fifteen celled, each cell containing six to ten seeds, imbedded in tenacious transparent mucus, which on drying becomes very hard, but remains transparent. *Seeds,* oblong, a little compressed, woolly. *Habitat,* Malabar and Coromandel.

Characters.—*Fruit roundish, about the size of a large orange, with a hard woody rind; usually imported in dried slices, or in fragments consisting of portions of the rind and adherent dried pulp and seeds. Rind about a line and a half thick, covered with a smooth pale-brown or greyish epidermis, and internally, as well as the dried pulp, brownish-orange, or cherry-red. The moistened pulp is mucilaginous.*

The pulp, and especially the rind, are astringent, besides being mucilaginous when moistened, the astringency being due to the presence of a kind of tannin.

EXTRACTUM BELÆ LIQUIDUM—Liquid Extract of Bael. —*Take of bael, 1 pound; distilled water, 12 pints; rectified spirit, 2 fluid ounces. Macerate the bael for twelve hours in one-third of the water; pour off the clear liquor; repeat the maceration a second and third time for one hour in the remaining two-thirds of the water; press the marc; and filter the mixed liquors through flannel. Evaporate to fourteen fluid ounces; and when cold, add the rectified spirit.*

Dose of the liquid extract, one to three or four liquid drachms, each fluid ounce representing an ounce of the fruit. It may be combined with other astringents in a mixture.

Bael is given as an astringent in diarrhœa and dysentery, chronic irritation of the bowels, &c.: it is suitable for weakly people, as it is said to give tone to the alimentary canal, without producing constipation. All parts of the tree are used medicinally in India, and are said to operate as a febrifuge, tonic, diaphoretic, and astringent. The astringency is confined to the unripe fruit. The ripe fruit has an opposite effect, being aperient rather than astringent. Bael may be administered in the form of decoction, or as sherbet, and the ripe fruit is made into preserve.

GUTTIFERÆ or CLUSIACEÆ—The Gamboge Order, or the Mangosteen Order.—Trees or shrubs, inhabiting tropical regions only,

and more frequently in moist places. The plants yield a yellow gum resin, which is acrid and purgative. The fruits of many of them are edible, and the seeds of some are oily. The genus *Garcinia* affords the officinal gamboge.

Cambogia — Gamboge. — A gum-resin obtained from Garcinia Morella, *Desrous.* var. pedicellata. Imported from Siam.

The exact species of Garcinia which yields the officinal or Siam gamboge, was till lately undetermined; the following have been from time to time suggested—*Garcinia Cochin-chinensis, Garcinia elliptica.* Ceylon gamboge has been referred to *Garcinia Cambogia* and to *Hebradendron Cambogioides. Garcinia pictoria* also yields a variety of gamboge.

Ceylon gamboge is said to be obtained by incising, or by cutting pieces out of, the bark early in the morning; from these wounds the soft light-yellow gum-resin exudes, stiffens on the surface, is scraped off the following day, and afterwards hardened by exposure to the sun. Siam gamboge is said to be obtained by cutting across the leaves and young branches, and collecting the gum-resin as it drops. These two varieties of gamboge are probably all but identical in their composition and medicinal properties; but the Ceylon gamboge, though occasionally met with in irregular masses, is not an article of European commerce, in consequence of its inferiority as a pigment, for which purpose gamboge is chiefly employed.

Characters of Siam Gamboge.—*In cylindrical pieces, breaking easily with a smooth conchoidal glistening fracture; colour tawny, changing to yellow when it is rubbed with water; taste acrid.*

Purity Test.—*An emulsion made with boiling water, and cooled, does not become green with the solution of iodine.* Preparation.—*Pilula Cambogiæ Composita.*

Siam or commercial gamboge is met with in two forms, namely, as pipe gamboge, and as lump or cake gamboge. Pipe gamboge is generally the better variety, but both kinds contain gamboge of inferior quality. Pipe gamboge may be either solid or hollow, and receives its cylindrical form by being poured whilst soft into bamboo stems; it is met with in pieces varying in length and thickness, and sometimes doubled upon themselves or agglutinated. Externally, it is generally striated and covered with a dirty greenish-yellow dust, derived from the pressure and contents of the bamboo. Lump or cake gamboge is met with in masses of several pounds weight, and is generally of an inferior kind, and mixed with impurities. It is only the finest variety of gamboge that has the smooth conchoidal fracture; the coarser kind breaks with a splintery fracture, is duller in appearance, and generally contains fragments of wood, twigs, fecula, and air cells. Gamboge is inodorous, and at first tasteless, but in a little while causes an acrid sensation in the throat, and the dust arising when it is powdered is very irritating to the nostrils. The powder is of a bright yellow colour. Gamboge is but slightly soluble in water, but when mixed with it, forms a yellow emulsion. By the successive action of ether and water, fine gamboge is completely dissolved, the resin being dissolved by the former, the gum by the latter; but impurities are left when the inferior kinds

are thus treated. Rectified spirit dissolves the resin, which is precipitated on the addition of water, and again dissolved by solution of potash, forming a clear red solution of gambogiate of potash. The iodine test is intended to detect starch as an impurity, the green colour being produced by the combination of the yellow of the gamboge with the blue iodide of starch.

Active constituents.—Gambogic acid, or resin of gamboge ($C_{20}H_{23}O_4$), about 70 to 75 per cent. in the finer qualities; gum (*Arabin*), about 20 to 25 per cent.

PILULA CAMBOGIÆ COMPOSITA—Compound Pill of Gamboge.—*Take of gamboge, in powder; Barbadoes aloes, in powder; compound powder of cinnamon, of each,* 1 *ounce; hard soap, in powder,* 2 *ounces: syrup, a sufficiency. Mix the powders together; add the syrup, and beat the whole into a uniform mass.*

Dose.—Of powdered gamboge, one to five grains; of the compound pill, five to ten grains.

Antidotes.—Allay irritation by demulcent drinks and enemata; small doses of opium; fomentations to the abdomen; the warm bath; stimulants when exhaustion ensues.

Gamboge in medicinal doses is a drastic hydragogue cathartic and diuretic, and in over-doses an irritant poison, causing vomiting, hyper-catharsis, severe tormina, inflammation, ulceration and mortification of the intestines, and fatal exhaustion. It is very rarely given alone, but either in combination with warm aromatic purgatives, as in the compound pill, or with calomel, cream of tartar, or jalap, in the treatment of dropsies, or as an adjunct to diuretic mixtures. Its use is contra-indicated in children, in debilitated persons, in pregnancy, and in all inflammatory and irritable states of the alimentary canal or adjoining viscera. It has been given also as a counter-irritant purgative in cerebral affections, and as an anthelmintic in tape-worm. A dose of sixty grains of gamboge has proved fatal.

SAPINDACEÆ.—The Soapwort Order.—Usually large trees or twining shrubs, rarely climbing herbs, inhabiting chiefly the tropical parts of South America and India. Many of the plants contain a saponaceous principle, some yield edible fruits and seeds, and many of them are poisonous; they possess also astringent, aromatic, diaphoretic, diuretic, and aperient properties. *Paullinia sorbilis,* the Guarana plant, produces seeds which are used both dietetically and medicinally. The seeds, after they are dried and deprived of their white aril, are pounded and kneaded into a mass, which is afterwards divided into oblong or rounded balls or cakes. These are used to make a beverage similar to our tea, cocoa, or chocolate, a portion of the mass being scraped off, mixed with water, and sweetened. It is largely used by the Indians of Rio Mauhé, and of other parts of Brazil, as a

nutritive beverage. As a medicine it is reputed stomachic, febrifugal, and aphrodisiac. The active principle of Guarana (guaranine) is considered to be identical with theine and caffeine, the active principles of tea and coffee.

CANELLACEÆ.—The genus *canella* has been placed by Martius in a separate order; some botanists have placed it in the *Guttiferæ,* others in the *Meliacæ.*

CANELLÆ ALBÆ CORTEX.—The bark of *Canella Alba; Dodecandria Monogynia;* the laurel-leaved Canella—Wild Cinnamon--Spurious Winter's Bark.

CHARACTERS.—*In quills or broken pieces, hard, of a yellowish-white or pale orange colour, somewhat lighter on the internal surface. It has an aromatic clove-like odour, and an acrid peppery taste.*

Canella has received the names of Wild Cinnamon and of Spurious Winter's Bark, in consequence of its having at first been mistaken for true cinnamon and true Winter's Bark. It is the inner bark of a tree which is commonly met with in the West India Islands and in South America. On the coast it seldom exceeds twelve or fifteen feet in height, but in the inland forests it is much taller, reaching even to forty or fifty feet.

Canella bark is met with in pieces varying from three or four to ten or twelve inches in length, either flat or quilled, according to the part of the tree from which it is taken, and from one to three or four lines thick. It is brittle, and readily forms a yellowish-white powder. It contains a volatile oil, bitter extractive, resin, a peculiar saccharine principle termed *canellin,* &c., and yields its properties to alcohol. Canella bark may be distinguished from Winter's bark by being pale on the inner surface, the inner surface of the latter being dark; and also by not being precipitated by nitrate of silver, nor by infusion of galls, nor by sulphate of iron.

Canella acts as an aromatic stimulant and tonic. It is seldom used alone, but generally as an adjunct to other tonics, or as a corrigent to resinous purgatives. It is used in the preparation of Vinum Rhei. The powdered leaves yield their active principles and colouring matter to melted lard, affording a preparation which has been recommended as a substitute for savin ointment. The powdered bark may be given in doses of ten to thirty grains.

VITACEÆ or AMPELIDEÆ—The Vine Order.—Climbing shrubby plants, inhabiting the warm and tropical regions of the globe. The grape vine has been carried to almost every part of the inhabited world, and has been much improved by cultivation. Officinal plant: *Vitis vinifera.*

Uvæ—Raisins.—Officinal plant: *Vitis vinifera,* Linn.; *Pentandria Monogynia*; the Grape Vine. Illustration, Plate 195, *Woodv. Med. Bot.* Officinal part: The ripe fruit, dried in the sun or with artificial heat; imported from Spain.

Botany.—A hardy shrub, varying much according to cultivation. *Branches,* prostrate, climbing, or erect, and tender or firm. *Leaves,* lobed, sinuate-dentate, smooth or downy, pale or deep green. *Flowers,* in loose or crowded panicles. *Fruit,* varying in colour, size, shape, and flavour, but acid, sweet, and agreeable when ripe. *Seeds,* often varying in number, and sometimes altogether wanting. *Habitat,* the shores of the Caspian Sea ; extensively cultivated.

Characters of Raisins.—*Fruits shrivelled and compressed, smooth, and free from sugary or saline incrustation, agreeably fragrant ; pulp soft, very sweet.*

Raisins are simply grapes dried either by exposure to the sun or by artificial heat, and are chiefly prepared in Spain, in Portugal, and in the Levant. The most esteemed kind is the Muscatel; Malaga, Sultana, and Smyrna raisins are also largely used. Corinthian raisins, commonly called *currants,* are the produce of a small grape which abounds in the Ionian Islands. The thief constituents of raisins are uncrystallisable *grape* sugar, acid tartrate of potash, malic and citric acids, mucilage, &c. Raisins are nutrient and demulcent, and are used as flavouring adjuncts to other medicines, such as the compound tincture of cardamoms and tincture of senna. Grapes are used as a dessert, and are given to the sick and convalescent for the sake of their cooling and refreshing properties. Grapes have also been given in large quantities in what is termed, on the Continent, the "grape cure" of certain chronic maladies.

LINACEÆ—The Flax Order.—Herbs, or rarely shrubs, inhabiting the south of Europe and the north of Africa chiefly, but also more or less distributed over various parts of the globe. The plants are remarkable for the mucilage and oil of their seeds, and also for the tenacity of their liber-fibres. They are generally emollient and demulcent, but some are bitter, purgative, or diuretic. Officinal plant: *Linum usitatissimum.*

Lini Semina—Linseed.—Officinal plant : *Linum usitatissimum,* Linn. ; *Pentandria Pentagynia ;* Linseed, Flax seed. Illustration, Plate 22, fasc. 5, *Flor. Lond.* Officinal parts :—1. *Lini semina,* the seeds : cultivated in Britain. 2. *Lini farina,* Linseed meal, the seeds ground and deprived of their oil by expression. 3. *Lini oleum,* Linseed oil, the oil expressed without heat from linseed. Officinal preparations : *Infusum Lini, Cataplasma Lini.*

Botany.—Annual. *Stem,* erect, slender, simple, smooth, one to two feet high. *Leaves,* alternate, simple, smooth, linear, lanceolate, sessile. *Flowers,* large, purplish-blue, in a corymbose panicle. *Capsules,* globular, each containing ten seeds. *Habitat,* indigenous, and largely cultivated.

From this plant, independently of the officinal preparations, are obtained several useful articles, namely, flax, from which is prepared linen, cambric, lint, and tow. Flax is obtained by steeping the plant, stripping off its bark, and then separating the fibres by beating. Tow consists of the short fibres, which are separated in the process of hackling. Lint is prepared by simply scraping linen. The fibre of flax, unlike that of cotton, which is twisted, is straight.

Characters of the Seed.—*Small, oval, pointed, flat, with acute edges, smooth, shining, brown externally, yellowish-white within, of a mucilaginous oily taste.*

The seed consists of two parts: an outer covering, *testa*, or seed-coat, which abounds in a condensed mucus, and has a bland mucilaginous taste; and an inner nucleus, kernel, or almond, which contains a fixed oil, and has an oily taste. The mucilage of linseed is yielded to hot water, giving a viscid fluid, which contains one part of the mucilage in solution, the other merely in suspension; that part which is insoluble is nitrogenous. The fluid reddens litmus from the presence of free acetic acid.

INFUSUM LINI—Infusion of Linseed.—*Take of linseed,* 160 *grains; fresh liquorice root, sliced,* 60 *grains; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for four hours, and strain.*

Lini Oleum—Linseed Oil. Characters.—*Viscid, yellow, with a faint odour and oleaginous taste.*

Linseed yields from 18 to 20 per cent. of oil by cold expression, and from 22 to 27 per cent. when heat is employed. The seeds are first bruised or crushed, and ground, and then either at once submitted to hydraulic or screw pressure (*cold drawn*), or are first exposed to a steam heat of 200° Fahr. The cold-drawn oil is paler, and has but little taste and odour; whereas that obtained by heat is darker in colour, and somewhat disagreeable in taste and odour. The oil is soluble in alcohol, and more so in ether. When exposed to the air it dries into a hard transparent varnish, and it does so much more readily after it is boiled, either alone or with a preparation of lead. Hence it is termed a *drying oil.*

Lini Farina—Linseed Meal.—The substance which remains in a flat, firmly coherent mass after the oil has been expressed from the kernels of the seeds, is called *oil-cake;* and this when powdered forms linseed meal. The best kind is that which is obtained from freshly made English oil-cake; foreign oil-cake and linseed meal are frequently adulterated.

CATAPLASMA LINI—Linseed Poultice.—*Take of linseed meal,* 4 *ounces; olive oil,* ½ *fluid ounce; boiling water,* 10 *fluid ounces. Mix the linseed meal gradually with the water, then add the oil with constant stirring.* When powdered linseed from which the oil has not been expressed is used, the addition of olive oil is not required; but as the meal does not keep well with the oil in it, which soon turns rancid, the above formula is substituted for that of the London Pharmacopœia.

Dose.—Of the infusion, two to four fluid ounces; of the oil, as a laxative (rarely used), from a half to one fluid ounce.

Linseed acts as a demulcent and emollient. *Linseed Tea,* made, like the officinal infusion, with the seeds, sweetened with honey, sugar candy, or liquorice root, and flavoured with lemon, is an agreeable pectoral drink, and when largely taken, acts somewhat as a soothing diuretic. The oil acts as an emollient, and with *Liquor*

Calcis, forms the celebrated *Carron Oil*, used as an application to burns. The oil acts also as a laxative, but is rarely used as such otherwise than as an enema. The poultice made with the meal is an excellent emollient application, useful in a variety of cases; the meal should be fresh, otherwise, especially if it contain rancid oil, it may irritate the skin and cause a disagreeable pustular eruption. The demulcent effects of linseed are valuable in bronchial affections, diarrhœa, dysentery, inflammation of the abdominal viscera, inflammatory affections of the genito-urinary passages, &c.

LINUM CATHARTICUM—Purging Flax—a small, indigenous plant, growing abundantly on dry heaths, was formerly, but is not now, officinal. It acts as a cathartic in doses of one drachm of the powder, or two to four drachms of the plant given as an infusion; and in smaller doses is diuretic.

OXALIDACEÆ—The Wool-sorrel Order.—Herbaceous or shrubby plants, inhabiting hot and temperate climates.

Oxalis acetosella—Decandria Pentagynia; Wood-sorrel—is a small plant met with in shady places throughout Europe. It has an acid but harsh taste when chewed. It contains quadroxalate of potash, which is hence sold under the names of Salt of Sorrel or Salt of Wood-sorrel. Wood-sorrel acts as a refrigerant, antiscorbutic, and diuretic, and has been given in febrile diseases and in scurvy, but it is not much used. It may be made into an infusion with milk or water; and the leaves, as an antiscorbutic remedy, may be added to salad. The quadroxalate of potash has frequently led to poisoning both intentionally and accidentally. The symptoms and treatment in such circumstances correspond with those given when speaking of oxalic acid, which see page 172.

ZYGOPHYLLACEÆ—The Bean-Caper and Guaiacum Order.—Herbs, shrubs, or trees, inhabiting generally the warm regions of the globe beyond the tropics. The plants possess stimulant, alterative, diaphoretic, or anthelmintic properties. Officinal plant: *Guaiacum officinale.*

Guaiaci Lignum—Guaiacum Wood.—Officinal plant: *Guaiacum officinale*, Linn.; *Decandria Monogynia;* Officinal Guaiacum Tree. Illustration, plate 90, *Steph. and Church Med. Bot.* Officinal parts:—1. *Lignum Guaiaci*, the wood sliced or coarsely turned; imported from St Domingo and Jamaica. 2. *Resina Guaiaci*, guaiac resin, or guaiacum, the resin obtained from the stem by natural exudation, by incisions, or by heat. Officinal preparations: *Mistura Guaiaci, Tinctura Guaiaci Ammoniata*. Guaiacum enters also into *Decoctum Sarsæ Compositum*, and *Pilula Hydrargyri Subchloridi Composita.*

Botany.—A large evergreen tree, from thirty to fifty or sixty feet in height. *Stem*, crooked; wood hard, heavy, and remarkable for its cross-grained appearance, the fibres crossing each other diagonally. *Leaves*, evergreen, bijugate, abruptly pinnate; leaflets smooth, obovate, or oval, obtuse. *Flowers*, pale blue, eight to ten, on long single-flowered

peduncles, rising from the axils of the upper leaves. *Fruit,* capsular, fleshy, reddish-yellow. *Seeds,* solitary in each cell, pendulous from the axis. *Habitat,* West India Islands.

CHARACTERS OF THE WOOD.—*Extremely hard; the young or outer wood is pale brown, the old or central wood is greenish-brown.*

PURITY TEST.—*Nitric acid applied to the dark wood produces a bluish-green colour.*

Guaiac wood, or *Lignum vitæ,* as it is also called, is extremely hard, heavy, and durable, and is therefore used for mechanical purposes when weight and resistance are required, as in the sheaves of blocks, pestles, &c. It is imported in logs or billets of considerable size, and may be readily recognised by the peculiar arrangement of its fibres, and the distinction between the old and new wood. On examining a section of the wood, it is seen to consist of an outer portion of a pale brown or yellow colour, encircling an inner and darker portion. The outer portion is the young wood, the alburnum or sap-wood, the inner being the duramen or heart-wood, in which is deposited the guaiac resin, whereby it is rendered dark greenish-brown in colour. The fibres of the wood cross each other obliquely. The shavings, turnings, or raspings of guaiac wood, which are commonly met with in the shops, are subject to admixture with those of other woods; but the true wood may be recognised by the above test, and also by its cross-grained character. It has an acrid, resinous, pungent taste, and an aromatic odour when rubbed or heated. Its specific gravity is 1·33, and therefore it sinks in water. Its chief constituents are the resin, and an acrid principle, to the former of which chiefly, but perhaps partially also to the latter, its medicinal properties are due.

Guaiaci Resina—Guaiacum Resin, or Guaiacum.

CHARACTERS.—*In large masses of a brownish or greenish-brown colour; fractured surface resinous, translucent at the edges.*

PURITY TEST.—*A solution in rectified spirit strikes a clear blue colour when applied to the inner surface of a paring of raw potato.*

The resin of guaiacum may be obtained from the wood in one of four ways:—1. By collecting it from the surface of the stem, where it concretes in the fissures by natural exudation. 2. By incising the bark of the tree, whereby its escape is greatly facilitated. 3. By boring holes lengthwise through the billets and logs of the stem and larger branches, then heating them in a fire, and collecting, in a calabash, the resin as it flows from the distant aperture. 4. By boiling the chips or raspings in salt and water (the boiling point of which is much higher than that of plain water), and skimming off the resin from the surface. Guaiac resin is met with in two forms: in tears and in masses. The tears are of round or oval form, and of different sizes; the masses, in which it is more commonly seen, are of considerable size, and generally contain chips of wood, bark, and other impurities; the former is known as *Guaiacum in Tears,* the latter as *Lump Guaiacum.* Guaiacum resin is semitransparent and brittle, having a brilliant, shining, vitreous, and resinous fracture. Externally it is covered with a grey dust, and its powder is also grey at first, but gradually assumes a greenish colour when exposed to the light. The outer surface is of a brownish-green or olive-green

colour, but the recently fractured surface is reddish-brown, all parts becoming more or less green on exposure to light. When powdered or heated, it emits a balsamic odour, but otherwise it is nearly inodorous. When chewed it softens in the mouth, and, though with but little perceptible taste, causes a burning sensation in the throat. It consists chiefly of a resin, which has the properties of an acid, and is termed *Guaiacic acid*, and extractive. Water dissolves it but very slightly, acting only upon the extractive, and not upon the resin : the fixed and volatile oils scarcely act upon it ; but it is readily soluble in alcohol, in ammoniated alcohol, in ether, and in alkaline solutions. Water added to the alcoholic solution precipitates the resin. The resin is met with in various degrees of purity, and occasionally other resins are fraudulently added to it ; the test of the pharmacopœia refers to the effect of gluten in striking a clear blue colour with a tincture of the resin.

MISTURA GUAIACI—Guaiac Mixture.—*Take of guaiacum resin, in powder, refined sugar, of each ½ ounce ; gum acacia, powdered, ¼ ounce ; cinnamon water,* 1 *pint. Triturate the guaiacum with the sugar and the gum, adding gradually the cinnamon water.*

TINCTURA GUAIACI AMMONIATA—Ammoniated Tincture of Guaiac.—*Take of guaiacum resin, in powder,* 4 *ounces ; aromatic spirit of ammonia, a sufficiency. Macerate the guaiacum in fifteen fluid ounces of the aromatic spirit of ammonia for seven days in a well-closed vessel, with occasional agitation, and filter, then add sufficient aromatic spirit of ammonia to make one pint.*

Dose.—Of the resin, either in powder, bolus, electuary, or mucilage, ten to thirty grains ; of the mixture, half a fluid ounce to two fluid ounces ; of the ammoniated tincture, thirty minims to a fluid drachm. It is to be remembered that water precipitates the resin from its alcoholic solution, therefore, when prescribed in mixture, the tincture must be associated with syrup or mucilage to suspend the resin, as in the preparation of the mixture.

Guaiacum acts as a stimulant, diaphoretic, and alterative, and it also increases the discharge of urine when its action upon the skin is not facilitated. In over-doses it produces burning in the throat, vomiting, purging, and febrile disturbance, and even in moderate doses its administration is occasionally followed by slight salivation or a cutaneous eruption. The cases in which it has been most useful are chronic rheumatism, atonic gout, cynanche tonsillaris, syphilitic eruptions and pains, amenorrhœa, hyper-secretions of mucous membranes, &c. It is suitable in the cases of old and debilitated persons, and is contra-indicated in acute inflammatory states of the system.

RUTACEÆ—The Rue Order.—Trees, shrubs, or herbs, inhabiting the southern part of the temperate zone. The plants have a peculiar penetrating odour and bitter taste, and are employed medicinally as antispasmodics, tonics, febrifuges, or diuretics. The *Rutaceæ* have been

divided into two sub-orders—1. *Ruteæ;* 2. *Diosmeæ.* Officinal plants: *a.* of the *Ruteæ, Ruta graveolens; b.* of the *Diosmeæ, Barosma betulina, Barosma serratifolia, Barosma crenulata, Galipea Cusparia.*

Oleum Rutæ—English Oil of Rue.—Officinal plant: *Ruta graveolens,* Linn.; *Decandria Monogynia;* Common or Garden Rue. Illustration, plate 37, *Woodv. Med. Bot.* The oil distilled in England from the fresh leaves and the unripe fruit.

Botany.—A small, branching under-shrub, two to three feet high, with a strong, disagreeable odour. *Stem,* straight, dull greenish, somewhat striated. *Leaves,* alternate, bluish-green; leaflets, thickish, tapering towards the bases, dotted. *Flowers,* in a terminal corymb, yellow. *Fruit,* roundish, warty, four or five-lobed. *Seeds,* dotted. *Habitat,* South of Europe; cultivated in gardens. Every part of the plant has a strong, disagreeable odour, and a bitter, acrid taste.

Characters of the Oil.—*Colour pale yellow, odour disagreeable, taste bitter, acrid.*

The leaves afford the largest quantity of oil when the seed-vessels are fully developed but still unripe, and at that time, if rubbed upon the skin, they will act as vesicants. The oil is obtained, by distillation with water, from the fresh herb, the leaves, the flowers, and seed-vessels abounding in oil-vesicles. The plant loses, in a great measure, its peculiar properties by drying. The oil becomes darker with age; its specific gravity is ·911.

Dose.—Of the oil, two to five minims, with syrup. Of the fresh herb, an infusion may be made (one ounce to a pint of boiling water, infused for an hour), and given in doses of one or two fluid ounces. A syrup of rue is kept by most druggists, consisting of—Oil of rue, twelve minims; rectified spirit, four fluid drachms, added to a pint of simple syrup. This is given as a domestic medicine to children suffering from flatulent colic, in doses, according to age, up to two teaspoonfuls.

Rue acts as a stimulating antispasmodic, and in over-doses as a narcotico-irritant. It is sometimes resorted to for the criminal purpose of procuring abortion, and was formerly much employed as an emmenagogue. Externally, the oil of rue acts as an irritant and vesicant. The preparations of rue have been recommended in amenorrhœa, chlorosis, hysteria, epilepsy, infantile convulsions, worms, &c.; but it is now chiefly used in the flatulent colic of children, administered either by the stomach or as an enema.

Buchu Folia—Buchu Leaves.—Officinal plants:—1. *Barosma betulina* (*Bartling and Wendland*). Illustration, plate 404, vol. v. *Lodd. Cab.* (*Diosma crenata*). 2. *Barosma crenulata* (*Wild. Enum. Sup.*) Illustration, plate 3413, vol. lxii. *Bot. Mag.* 3. *Barosma serratifolia* (*Willd. Enum.*) Illustration, plate 456, vol. xiii. *Bot. Mag.* (*Diosma serratifolia*); *Pentandria Monogynia.* Officinal part: The dried leaves; imported from the Cape of Good Hope. Officinal preparation: *Infusum Buchu, Tinctura Buchu.*

Botany.—Shrubs, with opposite or alternate, smooth, leathery, flat dotted leaves, and axillary flowers on single or three-flowered peduncles. *Habitat,* Cape of Good Hope.

CHARACTERS OF THE LEAVES.—*Smooth, marked with pellucid dots at the indentations and apex; having a powerful odour and a warm camphoraceous taste.* 1. *About three quarters of an inch long, coriaceous, obovate, with a recurved truncated apex, and sharp cartilaginous spreading teeth.* 2. *About an inch long, oval-lanceolate, obtuse, minutely crenated, five-nerved,* 3. *From an inch to an inch and a half long, linear-lanceolate, tapering at each end, sharply and finely-serrated, three-nerved.*

The leaves vary in appearance according to the species from which they are obtained; they are generally smooth and shining, of a pale yellowish-green colour, have a strong disagreeable odour, and a warm and rather pungent taste. They are coriaceous, either serrated or crenated, and are studded, especially on the under surface and near the margins, with glands containing an essential oil. These glands, or oil-vesicles, constitute the pellucid dots observed upon the leaves. The volatile oil of Buchu contained in these vesicles is of a yellowish-brown colour, and has the peculiar odour of the leaves. Besides this, the leaves contain also a bitter extractive termed *Diosmin,* which is soluble in water, but neither in alcohol nor in ether; it is of a brownish-yellow colour, pungent odour, and bitter taste. Portions of the stalks, the flowers, and fruit of the plants, are often intermingled with the leaves.

INFUSUM BUCHU—INFUSION OF BUCHU.—*Take of Buchu, bruised,* ½ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain.*

TINCTURA BUCHU—TINCTURE OF BUCHU.—*Take of Buchu leaves, in coarse powder,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the Buchu for forty-eight hours, with fifteen ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of the spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of the powdered leaves (rarely used), twenty to thirty grains; of the infusion, one or two fluid ounces; of the tincture, thirty minims to two fluid drachms.

Buchu acts as an aromatic stimulant, tonic, diaphoretic, and diuretic, operating beneficially upon the mucous membrane of the alimentary canal, and especially so upon the urinary passages. It is chiefly employed in chronic affections of the genito-urinary organs, in which there is considerable mucous discharge, associated with more or less of general debility and dyspepsia. It should be continued for some time.

CUSPARIÆ CORTEX—CUSPARIA BARK.—Officinal Plant: *Galipea Cusparia,* D.C.; *Pentandria Monogynia;* Cusparia or Angustura Bark.

Illustration, plate 149, *Steph. and Church. Med. Bot.* (*Bonplandia trifoliata.*) Officinal part: The bark, from tropical South America. Officinal preparation: *Infusum Cuspariæ.*

Botany.—A forest tree from sixty to eighty feet high. *Leaves*, alternate, trifoliate, fragrant; about two feet long, upon petioles nearly a foot in length; leaflets, sessile, unequal, with scattered glandular and pellucid dots. *Flowers*, white, in axillary racemes, almost terminal, with fascicles of hairs seated on glandular bodies on the outside. *Seed* solitary. *Habitat*, tropical South America. *Galipea officinalis*, to which Cusparia Bark has also been referred, is a smaller tree, not exceeding fifteen to twenty feet in height, and met with in the vicinity of the Orinoco. It is probable that Cusparia Bark is obtained from both of these trees, which by some authorities are believed to belong to the same species.

CHARACTERS.—*In straight pieces more or less incurved at the sides, from half a line to a line in thickness, pared away at the edges; epidermis mottled, brown, or yellowish-grey; inner surface yellowish-brown, flaky; breaks with a short fracture; the taste is bitter and slightly aromatic. The cut surface examined with a lens usually exhibits numerous white points or minute lines.*

PURITY TEST.—*The inner surface touched with nitric acid does not become blood-red.*

The bark, imported from South America, is met with either in flat pieces or in quills, from six to ten inches in length. Externally it is covered with a soft, greyish-white epidermis; internally it is brownish, and readily splits into laminæ. It has a bitter, aromatic, and somewhat acrid taste, and a strong peculiar odour. It breaks with a crisp resinous fracture. The bark contains, with other constituents, a volatile oil of pale colour and very light; it resembles the bark in odour and taste, and may be separated from it by distillation with water. The bark contains also a neutral bitter principle, termed *Cusparin* or *Angusturin*, which may be obtained in the form of tetrahedral crystals, is somewhat soluble in water, more so in alcohol, but not at all in the volatile oils, or in ether. Nitric acid turns it yellowish-green, sulphuric acid yellowish-brown, and it is precipitated from its solution by tincture of nutgalls. The bark contains also two kinds of resin, one bitter and hard, the other elastic. Cusparia is not much subjected to adulteration, but occasionally the serious mistake has occurred of substituting the bark of the *Strychnos Nux-vomica.* Several cases of poisoning have occurred on the Continent from this error. So frequent were these casualties at one time in Austria, that the Government ordered all the Cusparia in the empire to be destroyed. The substituted bark received the name of *False* or *Spurious Angustura Bark.* No fatal case has occurred in this country, probably owing to its comparatively little use; but Dr Neligan found that a specimen of the bark, obtained from a shop in Dublin, contained a large quantity of the bark of *Strychnos Nux-vomica.* The chief distinguishing characters between the two kinds of bark are, that the true bark occurs in quills, or in flattened pieces, almost straight, has a disagreeable odour, and a bitter and somewhat acrid persistent taste; when dry, it is readily broken or cut, and is light; when broken, it per-

sents a dull and blackish surface, whilst externally it is whitish or slightly yellow; its outer surface is not turned dark green, nor its inner surface blood-red by nitric acid; and finally, the inner surface of the bark is readily separable into laminæ. On the other hand, the bark of the *Strychnos Nux-vomica,* although also occurring in quills and in flattened pieces, is usually very much twisted; it has scarcely any odour, its bitter taste is intense and very persistent; it is heavy, compact, and neither easily cut nor broken; it has a resinous fracture; externally it is sometimes whitish, but is usually marked either by spots, or by a complete layer of a spongy rust-coloured substance, which is turned dark green, or nearly black, by nitric acid. The inner surface is not separable into laminæ, but is rendered blood-red by nitric acid.

INFUSUM CUSPARIÆ—INFUSION OF CUSPARIA.—*Take of Cusparia, in coarse powder,* ½ *ounce; distilled water at* 120°, 10 *fluid ounces. Infuse in a covered vessel for two hours, and strain.*

Dose.—Of the powdered bark, ten to thirty grains; of the infusion, half a fluid ounce to two fluid ounces.

Cusparia acts as a stimulant, aromatic, non-astringent tonic, and as a febrifuge. It is administered in atonic dyspepsia, in convalescence from acute diseases, in the latter stages of diarrhœa and dysentery, &c.; and in tropical South America it is highly esteemed as a febrifuge in intermittent and malignant bilious fevers. In large doses it causes nausea and purging.

SIMARUBACEÆ—The Quassia or Simaruba Order.—Shrubs or trees, inhabiting principally the tropical parts of India, America, and Africa. The plants are generally characterised by a bitter principle, and are employed as tonics and febrifuges. Officinal plant, *Picræna excelsa.*

QUASSIÆ LIGNUM—QUASSIA WOOD.—Officinal Plant: *Picræna excelsa,* Lindl.; *Polygamia Monœcia;* the Bitter Wood Tree, Jamaica Quassia. Illustration, plate 173, *Steph. and Church Med. Bot.* (*Quassia excelsa.*) Officinal part: The wood, from Jamaica. Officinal preparations: *Extractum Quassiæ, Infusum Quassiæ, Tinctura Quassiæ.*

Botany.—An erect tree, from fifty or sixty to a hundred feet in height, with a smooth dark-grey bark. *Leaves,* unequally pinnate; leaflets opposite, four to eight pairs, stalked, oblong, acuminate, unequal at the base. *Flowers,* racemose, small, pale, yellowish-green, polygamous. *Drupes,* three, only one of which ripens, is about the size of a pea, and forms a black shining globose nut, with a fragile shell. *Habitat,* West India Islands.

CHARACTERS OF THE WOOD.—*Billets varying in size, seldom thicker than the thigh. Wood dense, tough, yellowish-white, intensely and purely bitter. Also chips of the same.*

Quassia is imported from Jamaica, in billets of various sizes, both as to length and thickness. The bark which covers the logs is smooth and brittle. The wood is inodorous, intensely bitter, and whitish, becoming

yellow on exposure. It is kept in the shops in chips, which are apt to be mixed with those of other wood, a sophistication which may be readily detected by the absence of bitterness. Quassia contains a neutral bitter principle called *Quassite* or *Quassin*, which may be obtained in small white prismatic crystals ; it is inodorous, but intensely bitter, scarcely soluble in water or in ether, but readily so in alcohol. The wood is tough, and therefore difficult to powder.

EXTRACTUM QUASSIÆ—EXTRACT OF QUASSIA.—*Take of Quassia wood, rasped,* 1 *pound; distilled water, a sufficiency. Macerate the Quassia with eight fluid ounces of the water for twelve hours; then pack in a percolator, and adding more of the water, allow the liquor slowly to pass, until the Quassia is exhausted. Evaporate the liquor, filter it before it becomes too thick, and again evaporate by a water-bath, until the extract is of a suitable consistence for forming pills.*

INFUSUM QUASSIÆ—INFUSION OF QUASSIA.—*Take of Quassia wood, in chips,* 60 *grains*; *cold distilled water,* 10 *fluid ounces. Macerate in a covered vessel for half-an-hour, and strain.*

TINCTURA QUASSIÆ—TINCTURE OF QUASSIA.—*Take of Quassia wood, in chips,* $\frac{3}{4}$ *ounce; proof spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation; then strain, press, filter, and add sufficient proof spirit to make one pint.*

Dose.—Of the extract, five grains and upwards, or as a vehicle for other medicines, especially chalybeate, or other metallic tonics; of the infusion, one or two fluid ounces; of the tincture, one-half to two fluid drachms.

Quassia acts as a pure bitter tonic and stomachic; somewhat also as an anthelmintic, and it is said, moreover, to possess narcotic properties. In over-doses it causes vomiting. It is given in atonic dyspepsia, in convalescence from acute diseases, and from delirium tremens, and it has been also employed as a febrifuge in intermittent fever. As an anthelmintic it is given both by the stomach and as an enema. It is commonly used in combination with alkalies, in the dyspepsia which follows free living, and is valuable as a vehicle for chalybeate medicines, with which, as it contains no tannin, it is compatible.

Simaruba amara—Simaruba.—The mountain damson of Jamaica, furnishes a root-bark which is met with in pieces of several feet in length, doubled upon themselves, and either flat or quilled. It contains a principle closely resembling Quassin. It acts as a bitter tonic, and has been especially recommended in the advanced stages of diarrhœa and dysentery. The seeds of *Simaba cedron*, a tree of New Granada, are used in Central America as a febrifuge, and also as a specific against the bites of venomous snakes.

SUB-CLASS II.—CALYCIFLORÆ.

1. *Polypetalæ or Dialypetalæ.*

RHAMNACEÆ—The Buckthorn Order.—Shrubs or trees, generally distributed. The plants generally possess acrid and purgative properties; some are bitter, tonic, and astringent, others furnish edible fruits. Officinal plant: *Rhamnus catharticus.*

RHAMNUS—BUCKTHORN.—*Rhamnus catharticus,* Purging Buckthorn; *Pentandria Monogynia.* The plant is common in this country, in woods and hedgerows. It is a spreading shrub, from eight to ten feet high, the older branches forming thorny terminal spines; leaves, ovate, dentated; flowers, small yellowish-green; fruit, a small round berry, black when ripe, four-celled. It flowers in May, and the fruit ripens in September. Seeds, four, hard, ovate, triangular, keeled. The fruit of *Rhamnus frangula,* which is sometimes mixed with that of *R. catharticus,* has only two seeds. The fruit contains a purgative principle, acetic acid, colouring matter, mucilage, &c., and has a disagreeable odour and taste. The purgative principle is called *Rhamnicine,* and, according to Winkler, is a glucoside, convertible into *Cathartine* and grape sugar. The *succus Rhamni* and *Syrupus Rhamni* are now made officinal.

RHAMNI SUCCUS—BUCKTHORN JUICE.—*The recently expressed juice of the ripe berries of common Buckthorn, Rhamnus catharticus,* Linn.

It is employed in the preparation of

SYRUPUS RHAMNI—SYRUP OF BUCKTHORN.—*Take of Buckthorn juice,* 4 *pints; ginger, sliced, pimento, bruised, of each,* $\frac{3}{4}$ *ounce; refined sugar,* 5 *pounds, or a sufficiency; rectified spirit,* 6 *fluid ounces. Evaporate the juice to two pints and a half, add the ginger and pimento, digest at a gentle heat for four hours, and strain. When cold add the spirit, let the mixture stand for two days, then decant off the clear liquor, and in this dissolve the sugar with a gentle heat, so as to make the specific gravity* 1·32.

The syrup of buckthorn may be given in doses of one to two fluid drachms; the fresh juice may also be used in similar doses; ten to twenty of the berries may be taken, or one to three grains of the active principle. Both the berries and their juice act as powerful hydragogue cathartics. The berries are apt to act violently, producing liquid evacuations, nausea, intense thirst, and tormina. The syrup is sometimes added as an adjuvant to other purgative medicines, and is also believed to act moderately as a diuretic. The preparations of buckthorn are seldom or never prescribed alone.

ANACARDIACEÆ—The Cashew or Sumach Order.—Trees or shrubs, chiefly inhabiting tropical America, Africa, and India; but a few extend beyond the tropics. The plants abound in a milky, resinous, or

somewhat gummy acrid and poisonous juice, which sometimes becomes black on drying. The fruits of some are edible. Officinal plant: *Pistacia Lentiscus.*

Mastiche—Mastich.—Officinal plant: *Pistacia Lentiscus,* Linn.; *Diœcia Pentandria;* the Mastich Tree. Illustration, plate 130, *Steph. and Church, Med. Bot.* Officinal part: A resinous exudation from the stem, obtained by incision; produced in the island of Scio.

Botany.—A shrub, about ten or twelve feet in height. *Leaves,* abruptly pinnate; leaflets, eight to ten in number, small lanceolate, somewhat linear or ovate; petiole winged. *Flowers,* diœcious, small, in axillary racemes. *Fruit,* small, roundish, brownish-red when ripe. *Habitat,* South of Europe.

Characters.—*Small irregular yellowish tears, brittle, becoming soft and ductile when chewed, having a faint agreeable odour.*

Mastich is obtained from the tree by incising the stem transversely. This is done in August or September. As the fluid escapes, it either hardens upon the tree (when it is called *Mastich in tears*), or falls upon the ground and forms the common mastich. It is usually met with in roundish or flattened tears of a pale yellow colour, having a vitreous fracture, a fragrant agreeable odour, and a mild aromatic taste. It contains, besides other constituents, a volatile oil and two varieties of resin. Of the resins, one is soluble in alcohol, has the properties of an acid, combines with bases, and is called *Mastichic acid;* the other, called *Masticine,* is insoluble in alcohol, but is soluble in ether, and in the alcoholic solution of the mastichic acid resin; it is elastic and tenacious, and upon it depends the toughness of mastich.

Mastich acts like the ordinary coniferous turpentines, but is more agreeable to the taste. It is seldom used in medicine now, but, like the turpentines, it was formerly used to check chronic discharges from mucous membranes, especially the genito-urinary tract, as in leucorrhœa and chronic affections of the bladder and urethra, and also in debilitating discharges from the alimentary and broncho-pulmonary mucous membranes. It is sometimes used as a masticatory to impart fragrance to the breath, and is employed by dentists to fill the cavities of hollow teeth.

Pistacia Terebinthus, the Pistacia or Chian Turpentine Tree, furnishes the liquid oleo-resinous exudation known as Chian turpentine. It is a tree from twenty to forty feet in height, inhabiting the South of Europe, North of Africa, Asia Minor, and Syria; but the oleo-resin is chiefly obtained from the Island of Scio or Chio. Chian turpentine is obtained from the tree by making transverse incisions into the stem with a hatchet; each tree is said to yield from eight to ten ounces of the turpentine. It is of a greenish-yellow colour, and about the consistency of honey; its properties resemble those of the coniferous turpentine to a great extent, but it is more agreeable in taste and odour: being expensive, the common kinds of turpentine are apt to be mixed with it.

When long kept, it assumes the characters of a resin from the loss of its volatile oil. Chian turpentine resembles the coniferous kinds in its action, and is used in similar cases. It may be given in doses of ten, twenty, or thirty grains, in pill, or made into an emulsion with yolk of egg or mucilage.

Pistacia vera.—The Pistachio-nut Tree furnishes the Pistachio or Pistacia nut, the greenish-coloured kernels of which contain oil. They are esteemed for their flavour by the Turks and the Greeks, and are used as an article of diet, with pepper and salt.

Rhus Toxicodendron—the Poison-Oak of North America; *Pentandria Digynia;* Sumach, the Trailing Poison-Oak.—This is a shrub of one to three feet in height, with numerous branching stems covered with a brown bark; its leaves are pinnate, with an odd one; the leaflets are angularly incised and downy. *Flowers,* greenish-white. *Fruit,* a round drupe about the size of a pea. The juice, which is milky and acrid, turns black on exposure to the atmosphere, forming an indelible ink on linen or cotton. Several species of this genus (*Rhus*) have more or less poisonous properties. *Rhus radicans,* the poison-vine or poison-ivy, closely resembles *R. Toxicodendron;* and *Rhus venenata* is the poison-ash or poison-elder. So powerful is the *Rhus Toxicodendron* in its operation upon some constitutions, that the emanations from it, when wafted by the wind upon them, are sufficient to cause alarming symptoms. It is especially during the night, or when growing in shady places that these emanations, consisting of a hydro-carburetted gas and an acrid vapour, are most baneful. The symptoms which have followed as the effects of these emanations were, itching, redness, erysipelatous œdema, and vesication of the exposed parts of the body, especially the face and hands, these parts subsequently undergoing desquamation. So great has been the swelling in some cases, as even, it is said, to have almost obliterated the features. It has not this effect upon all persons alike; some appear to enjoy an immunity from it. When administered internally in small doses, it acts as a diaphoretic, diuretic, and slightly as a laxative; whilst by its stimulating action upon the nervous system it is said to cause twitchings and spasmodic movements in paralysed parts. In larger doses it acts as an acro-narcotic, causing poisonous symptoms, of which the chief are considerable irritation of the stomach, with vomiting, the patient being rendered subsequently stupid and drowsy. It has been used medicinally chiefly for the purpose of arousing nervous energy in old-standing paralysis, in amaurosis, in some obstinate cutaneous diseases, in chronic rheumatism, &c. *Dose* of the powdered leaves, half-a-grain to a grain, cautiously increased.

Mangifera Indica furnishes the Mango, a drupaceous fruit, which is highly esteemed in tropical countries. Several varieties of it are cultivated, which differ much in appearance and flavour.

AMYRIDACEÆ—The Myrrh and Frankincense Order.—Trees or shrubs, natives of tropical India, Africa, and America. The plants abound in fragrant balsamic resin; some are poisonous, others bitter, purgative, and anthelmintic. Officinal plants: *Balsamodendron myrrha, Canarium commune.*

Myrrha—Myrrh.—Officinal plant: *Balsamodendron myrrha*, Ehrenb.; *Octandria Monogynia;* the Myrrh Tree. Illustration, plate 357, *Nees, Plant. Med.* Officinal part: A gum-resinous exudation from the stem; collected in Arabia Felix and Abyssinia. Officinal preparation: *Tinctura Myrrhæ:* it enters also into *Decoctum Aloes Compositum, Mistura Ferri Composita, Pilula Aloes et Myrrhæ, Pilula Rhei Composita,* and *Pilula Assafœtidæ Composita.*

Botany.—*Stem,* shrubby, arborescent; branches, squarrose, spinescent. *Leaves,* ternate; leaflets, obovate, obtusely denticulate at the apex; the lateral smooth. *Flowers,* unknown. *Bark,* pale ash-grey, approaching white. *Wood,* yellowish-white; both it and the bark have a peculiar odour. *Fruit,* acuminate, ovate, smooth, brown, somewhat larger than a pea, supported on a very short stalk. *Habitat,* Arabia Felix, Abyssinia.

CHARACTERS.—*In irregular-shaped tears or masses, varying much in size, somewhat translucent, of a reddish-yellow or reddish-brown colour, fractured surface irregular and somewhat oily; odour agreeable and aromatic; taste acrid and bitter.*

When freshly exuded, myrrh is soft and of a pale-yellow colour, but it soon hardens and becomes darker. It is imported from Bombay, being first carried there from the Gulfs of Arabia and Persia. All the varieties of myrrh are now imported from the East Indies, but formerly the finer varieties came from Turkey, and only the coarser from India. Turkey myrrh, the finest quality, occurs in irregularly-shaped pieces, consisting of distinct or agglutinated tears, and usually has a dusty or powdery appearance externally. Some of the pieces are of considerable size, of a colour varying between pale yellow and red, and are fragile, breaking with a somewhat splintery and fatty fracture. When in large masses, the interior often presents whitish or yellowish opaque markings, which have been likened to the white marks upon the finger nails. This variety has the peculiar and agreeable odour of myrrh, and its aromatic, bitter, and acrid taste. East Indian myrrh is imported in chests, which either contain all the qualities mixed together, or only selected pieces: in the former case it is known as *myrrh in sorts,* in the latter as picked myrrh. The inferior kinds of myrrh are usually in small grains or tears, varying in colour from pale yellow to reddish brown, and are often mixed with Indian bdellium and Senegal gum.

Myrrh contains, besides other constituents, a volatile oil, resin, and gum. The volatile oil is thin, but of high specific gravity; it is at first colourless, but gradually assumes a yellow colour. It is soluble in alcohol, in ether, and in the fixed oils, and has the odour and taste of myrrh. Its solution is turned red by sulphuric, nitric, and hydrochloric acids. The resin is of two kinds, *soft* and *hard.* The gum also is of two varieties, the one soluble, the other insoluble in water. Myrrh is but partially soluble in water, but forms a white emulsion with it, the resin being suspended by the soluble gum. Rectified spirit takes up the volatile oil and the resin.

TINCTURA MYRRHÆ—TINCTURE OF MYRRH.—*Take of myrrh, in coarse powder,* 2½ *ounces; rectified spirit,* 1 *pint. Macerate the myrrh for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel,*

agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of the spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.

Dose.—Of the tincture, half a fluid drachm to two fluid drachms. Myrrh may be given in powder, or as an emulsion with water, in doses of ten to twenty or more grains, but it is rarely used alone. The tincture, freely diluted with water, forming a milky fluid, is used as a collutorium.

Myrrh, in small doses, acts as a stimulant and tonic, giving an impetus to the digestive organs, firmness and tone to the system generally, and an increase of muscular power; it causes also a diminution of the exhalations from mucous membranes, and hence gives rise to slight constipation. In large doses its stimulating effects are more fully developed, and there is a tendency to acridity. Topically, myrrh acts mildly as an astringent. It is rarely given alone internally, but in combination with other appropriate remedies. Its use is indicated where there is debility of the system and general relaxation of the tissues, and it is contra-indicated in inflammatory cases and in plethoric habits. It is useful in cases of chronic discharges from any of the mucous membranes, and by some it has been regarded as a useful emmenagogue, but its action as such is doubtful, except in so far as it operates as a stimulant and tonic. Topically, it is useful as a wash for the gums and throat, and as an application to foul ulcers.

Elemi—Elemi.—Botanical source undetermined; probably from *Canarium commune*, Linn.; *Polygamia Diœcia.* Illustration, plate 47, vol. ii., *Rumph. Amb.* Officinal part: A concrete resinous exudation, chiefly imported from Manilla. Officinal preparation: *Unguentum Elemi.*

Characters.—*A soft unctuous adhesive mass, becoming harder and more resinous by age; of a yellowish-white colour, with a rather fragrant fennel-like odour; almost entirely soluble in rectified spirit.*

Elemi, though long known in medicine, still remains a mystery as to the place of its growth, and as to the plant which produces it. Formerly, elemi came from Holland, and was supposed to be derived from one of the Dutch settlements, but it was afterwards said that this consisted chiefly of a factitious substance, made up of a variety of ingredients. The earliest trustworthy kind was imported from America, and in the present day there is a variety derived from Brazil, which is probably yielded by the *Icica Icicariba.* This was termed, by Geoffrey, False Elemi; it is the most esteemed of all, in consequence of the fragrance of its odour, which is due to the presence of a considerable quantity of volatile oil. There is also a variety of elemi imported directly from Mexico, which Dr Royle believes to be yielded by the

Elaphrium Elemiferum, a plant which attains a height of ten to twelve feet; has a slender stem three inches in diameter, consisting of a whitish spongy wood covered by a thin rugose reddish-brown bark, covered with a greyish epidermis, and lichens. It grows near Oaxaco, in Mexico. *Canarium commune,* cultivated in the Spice Islands for the sake of its kernels, furnishes a substance resembling elemi, and in its native state is probably the source of the elemi which is imported from Manilla. The substance furnished by *Canarium balsamiferum,* in Ceylon, and the resin termed *Arbol-a-brea,* probably yielded by *Canarium album,* at Manilla, both resemble elemi. Dr Pereira describes three varieties of elemi:— 1. *Elemi in flag leaves,* which is imported from Holland in triangular masses, weighing from one to two pounds each, and wrapped in a palm leaf. 2. *Elemi in lump,* which in its general characters corresponds to the former, but is of a much paler yellow colour than the third variety. 3. *Brazilian Elemi,* obtained probably from the *Icica Icicariba* by incisions into the stem, from which it flows rapidly during the subsequent twenty-four hours. But the variety most commonly met with in commerce is *Manilla Elemi,* which is imported in softish, strongly odorous masses from Singapore, and has the officinal characters. Elemi is at first soft and unctuous, but subsequently becomes hard and brittle; it is semi-transparent, and of yellowish-white colour, mixed with greenish spots. It has a strong, somewhat fennel-like odour, which is due to the presence of a volatile oil. It is upon the presence of this oil that its characteristic properties depend; it should therefore be used before it becomes too dry. Besides the volatile oil, it contains two varieties of resin.

UNGUENTUM ELEMI—Ointment of Elemi.—*Take of elemi, ¼ ounce; simple ointment, 1 ounce. Melt, strain through flannel, and stir constantly until the ointment solidifies.*

Elemi is a stimulant, and acts like the terebinthinates, but is never employed internally. The ointment is used as a stimulant application to chronic indolent sores, and also to promote the discharge caused by setons and issues.

Balm of Gilead, or *Balm of Mecca,* is produced either by *Balsamodendron Gileadense,* or by *B. Opobalsamum.* It flows from incisions made through the bark of the tree. It is at first oily and soft, but afterwards becomes hard and brittle. Formerly it was highly esteemed as a medicine, its action being similar to that of the liquid turpentines. It is not now used in European medicine; but in the East it is esteemed for its fragrance, and its medicinal virtues.

Bdellium.—A gummy resinous substance, of which there are two varieties, *Indian* and *African.* Indian Bdellium or False Myrrh (the Bdellium of Scripture), is probably derived from *Balsamodendron mukul* (*Amyris Commiphora*), and *B. Pubescens.* It has the characters of the coarser kinds of myrrh, with which it is often mixed. African bdellium is obtained from *Balsamodendron africanum* (*Heudolatia africanum*), a native of Senegal. When fresh, this occurs in roundish or oval tears, which have a dull waxy fracture; they afterwards become opaque.

Olibanum was formerly officinal. It is a gum-resin produced by *Boswellia thurifera*, and other species of the genus Boswellia. The olibanum of commerce is known by two names, *Indian* and *African*. Indian Olibanum is imported in chests from Bombay and Calcutta. It is met with in tears, which are roundish or oblong in shape, of a pale-yellowish colour, an agreeable resinous balsamic odour, and a warm and somewhat bitter taste. This is the more esteemed variety. Sometimes it is of a more or less reddish colour, and lightly covered with a white powdery substance, produced by the rubbing of the pieces against each other. The odour is increased and rendered more fragrant when the resin is heated or burned. African Olibanum is rarely met with in commerce. The tears are smaller than those of the Indian kind ; they vary in colour between yellow and red, and contain crystals of carbonate of lime mixed with them. Olibanum contains, besides other constituents, a volatile oil, which resembles oil of turpentine, but has a more agreeable odour, and two varieties of resin. Olibanum is not much used now in medicine; but was formerly a good deal employed to restrain mucous discharges in relaxed and debilitated conditions of the system.

LEGUMINOSÆ or FABACEÆ.—Herbs, shrubs, or trees, extensively distributed, having representatives in almost every part of the world, but they are most abundant in warm regions, and gradually diminish on approaching the poles. The order has been divided into three sub-orders. *Papilionaceæ*, *Cæsalpinieæ*, and *Mimoseæ*. The properties and uses of the plants of this order are very variable. Officinal plants :—1. Of the sub-order, *Papilionaceæ,* the Pulse section, *Myroxylon Pereiræ, Myroxylon Toluifera, Pterocarpus santalinus, Pterocarpus Marsupium, Sarothamnus scoparius, Glycyrrhiza glabra, Astragalus verus,* and other species, *Mucuna pruriens, Physostigma Venenosum.* 2. Of the sub-order, *Cæsalpinieæ,* the Senna section, *Cassia lanceolata, C. obovata, C. elongata, Cassia Fistula, Hæmatoxylon campechianum, Tamarindus indica, Copaifera multijuga,* and other species. 3. Of the sub-order, *Mimoseæ,* the Gum Arabic section, one or more undetermined species of *Acacia.*

Sub-order 1. *Papilionaceæ*—the Pulse section.—Most of the plants of this section furnish nutritious and wholesome articles of diet, both for men and the lower animals; but some are poisonous. They are met with in almost all parts of the world.

Balsamum Peruvianum—Balsam of Peru.—A balsam obtained from Myroxylon Pereiræ, *Klotzsch, Pharm. Journ.* vol. x. page 282, plate (*Myrospermum of Sonsonate*). It exudes from the trunk of the tree after the bark has been scorched and removed. From Salvador in Central America.

Botany.—A tall branching tree, with smooth, ash-coloured, resinous bark, and terete and warty branches. *Leaves*, alternate, stalked, impari-pinnate; leaflets, five to eleven, alternate, on short petioles, oblong or ovate, abruptly acuminate; when examined by a lens, they are seen to be marked with roundish or linear pellucid spots along the veins. *Flowers*, white, in axillary racemes. *Fruit*, a winged legume, pale yellow, one-celled and one-seeded. *Seed*, loose, and dry inside. *Habitat*, Sonsonate, in the state of San Salvador.

Characters of the Balsam.—*A reddish-brown or nearly black liquid, translucent in thin films; having the consistence of syrup, a balsamic odour, and an acrid slightly bitter taste; soluble in five parts of rectified spirit.*

Purity Test.—*Undergoes no diminution in volume when mixed with water.*

Peruvian balsam was formerly referred to the *Myrospermum peruiferum*, and it was believed to be the produce of that country. More recently, however, Dr Pereira received some specimens of the leaves, branches, and fruit of a plant, growing on the Sonsonate coast of Salvador, which he at first supposed to be those of *Myrospermum pubescens* of Kunth, but which, on more careful examination, he found to present characters differing from all the known species of Myrospermum. Much confusion had previously existed as to the place and manner of the production of the balsam; but, from the researches of Dr Pereira, it came to be known that it does not, at least in the present day, come from Peru at all, but from the state of San Salvador, in the republic of Guatemala, and that it is produced on the balsam coast of Sonsonate, between the ports of Acajutla and Libertad. The species examined by Dr Pereira, and adopted as the officinal plant, has been named by Dr Royle, *Myrospermum Pereiræ*, in honour of his late distinguished friend; but the editors of the Pharmacopœia, after Klotzsch, have named it *Myroxylon Pereiræ*, as it is undoubtedly a species of Myroxylon.

The balsam is obtained from the tree in question by the Indians of that neighbourhood, who take it to Sonsonate. Incisions are made into the stem, in which are placed rags, a fire is then kindled around the tree to liquefy the balsam, and when the rags are thoroughly soaked, they are removed, and are boiled in water, from which the balsam is afterwards separated by subsidence. A white balsam, the *Balsamo blanco*, is also obtained from the seeds and inner part of the fruit of the same tree; and a fragrant liquid, termed *Balsamito*, is prepared by digesting the inner part of the fruit in rum. Peruvian balsam, the black or liquid Balsam of Peru, is a reddish-brown or blackish fluid, of about the consistency of treacle, with an agreeable balsamic odour, which is increased by burning, and a warm acrid taste. It is inflammable, is soluble in alcohol, and boiling water dissolves out its cinnamic acid. Its chief constituents are two varieties of resin, oil of Balsam of Peru (cinnaméine), cinnamic acid, and extractive.

Peruvian balsam is not much subjected to adulteration. The water which it contains in excess when imported is removed at the Custom House, together with some refuse sedimentary matters, which are subsequently sold at a low price, and may be fraudulently used to represent the superior article. It is occasionally adulterated with castor oil and balsam of copaiva. Their presence will be suspected by any modifications of the physical characters of the balsam, and by the circumstance of its not forming an entirely brittle, resinous substance, when mixed with twice its weight of concentrated sulphuric acid, and afterwards slightly diluted with water, which it would do if pure. Copaiva may be detected by distilling a few drops of the balsam, and adding iodine; if copaiva be present, an explosion will follow. It should be entirely

soluble in or miscible with alcohol. The pharmacopœial test is intended to detect the presence of alcohol.

Dose.—(See after Balsam of Tolu).

Balsamum Tolutanum—Balsam of Tolu.—Officinal plant: *Myroxylon Toluifera*, HBK; Balsam of Tolu Tree. Officinal part: A balsam which exudes from the trunk of the tree after incisions have been made into the bark; from the mountains of Tolu, in New Granada. Officinal preparations: *Syrupus Tolutanus, Tinctura Tolutana.* It enters also into *Tinctura Benzoini Composita.*

Botany.—A tree, with smooth and warty branches, smooth leaves, and equilateral leaflets. The leaflets, seven to eight, are thin, membranous, ovate, oblong, acuminate, rounded at the base, shining and smooth. *Habitat,* South America, in the mountains of Tolu and Turbaco, and the banks of the Magdalena.

CHARACTERS.—*A soft and tenacious solid, with a fragrant balsamic odour, soluble in rectified spirit.*

Balsam of Tolu is obtained from incisions made into the stem of the tree, from which it flows only during the heat of the day, and is received into appropriate vessels. It is imported into this country either directly from Carthagena, or by way of Jamaica or New York. The balsam is at first soft and tenacious, but becomes hard and brittle when kept long after importation. It is transparent, reddish-brown, has a fragrant odour and agreeable taste. It is inflammable, melts with heat, and softens in the mouth; is soluble in alcohol and in ether, and imparts its acid to water. Its chief constituents are cinnaméine, cinnamic acid, and resin. Colophony is said to be an occasional adulteration of Balsam of Tolu; its presence may be suspected when the balsam, instead of being soluble in sulphuric acid, swells up and turns black, giving off at the same time the odour of sulphurous acid.

SYRUPUS TOLUTANUS—SYRUP OF TOLU.—*Take of Balsam of Tolu,* 1¼ *ounce; refined sugar,* 2 *pounds; distilled water,* 1 *pint, or a sufficiency. Boil the balsam in the water for half-an-hour in a lightly-covered vessel, stirring occasionally. Then remove from the fire, and add distilled water, if necessary, so that the liquid shall measure sixteen ounces. Filter the solution when cold, add the sugar, and dissolve with the aid of a steam or water bath. The product should weigh three pounds, and should have the specific gravity* 1·330.

TINCTURA TOLUTANA—TINCTURE OF TOLU.—*Take of Balsam of Tolu,* 2½ *ounces; rectified spirit, a sufficiency. Macerate the Balsam of Tolu in fifteen fluid ounces of the spirit, in a closed vessel, with occasional agitation, for six hours, or until the balsam is dissolved, then filter, and add sufficient rectified spirit to make one pint.*

Tincture of Tolu enters into the preparation of *Trochisci Acidi Tannici, Trochisci Morphiæ, Troschisci Morphiæ et Ipecacuanhæ, and Troschisci Opii.*

Dose.—Of Balsam of Peru, twenty minims to one fluid drachm, suspended in water by yolk of egg, mucilage, sugar, or honey, or dropped upon sugar, or in pills; of Balsam of Tolu, ten to thirty grains, sus-

pended in water by mucilage, yolk of egg, &c.; of Syrup of Tolu, one to two fluid drachms; of the Tincture of Tolu, twenty minims to two fluid drachms; when added to water it requires mucilage or sugar, &c., to suspend it.

The Balsams of Peru and Tolu act as stimulants and expectorants when given internally, and as stimulants and detergents when applied to wounds and sores externally. The circulation is increased in activity, and the secretion of the bronchial mucous membrane is more readily discharged under their influence. They appear to have a distinct predilection for the mucous membrane of the air passages, as copaiva has for the genito-urinary tract. They are employed chiefly in old standing affections of the bronchial mucous membrane,—as in chronic catarrhs, habitual winter coughs, &c., especially when there is torpor or debility of constitution. In consequence of their stimulant action they are contra-indicated in acute inflammatory affections. Formerly they were administered in phthisis, with a view of healing the pulmonary tissue in the same way as they act when applied to wounds externally; but this use has been abandoned. They are available in some chronic asthmatic cases. They, and their officinal preparations, may be employed as agreeable adjuvants to other stimulating expectorants, but they are seldom given alone. Externally, Balsam of Peru is employed as a stimulant and detergent application in alopœcia, to indolent and foul ulcers, bed sores, chapped nipples, &c.

Pterocarpi Lignum—Red Sandal-Wood.—Officinal plant: *Pterocarpus santalinus*, Linn.; *Diadelphia Decandria;* Red Sandal, or Red Sanders Wood Tree. Illustration, plate 254, *Woodv. Med. Bot.* Officinal part: The wood; from Coromandel and Ceylon.

This is the wood of a lofty tree inhabiting the mountains of Coromandel and Ceylon.

Characters.—*Dense heavy billets, outwardly dark brown, internally variegated with dark and lighter red rings, if cut transversely. Powder, blood-red, of a faint peculiar odour, and an obscurely astringent taste. Also chips of the same.*

The wood contains a peculiar crystallisable colouring principle, termed Santaline or Santalic acid. Alcohol, ether, and alkaline solutions abstract the colouring matter. The only medicinal use of the wood is to impart colour to the compound tincture of lavender.

Kino—Kino.—Officinal plant: *Pterocarpus Marsupium*, D.C.; *Diadelphia Decandria;* the Indian Kino Tree. Illustration, plate 116, *Roxb. Corom.* Officinal part: The juice obtained from incisions in the trunk, inspissated; imported from Malabar. Officinal preparations: *Tinctura Kino, Pulvis Kino compositus Opio.* It enters also into *Pulvis Catechu Compositus.*

Botany.—A lofty leafy tree; the outer coat of the bark is brown, the inner coat red, fibrous, and astringent. *Leaves,* alternate; leaflets, alternate, three to five inches long, deep green, shining, leathery, smooth. *Panicles,* terminal. *Flowers,* white, with a tinge of yellow. *Legume,* long-stalked, the under three-fourths orbicular, the upper side straight, the whole surrounded by a wavy membranous wing. *Seed,* solitary, and kidney-shaped. *Habitat,* coast of Malabar.

CHARACTERS.—*In small, angular, brittle, glistening, reddish-black fragments, translucent and ruby-red on the edges, inodorous, very astringent. When chewed, it tinges the saliva blood-red.*

Kino is obtained by making incisions in the bark round the stem when the tree is in blossom. Broad leaves are then placed and so fixed in the bark as to prevent the gum from falling upon the ground, as it oozes downwards to a suitable vessel placed below the leaf to receive it. The gum is next dried in the sun until it crumbles, and finally is packed in boxes for transportation.

East Indian Kino is met with in small glistening fragments, of angular shape, and of a reddish or blackish colour. In thin laminæ it is transparent and garnet-coloured. It is inodorous, is very astringent to the taste, and softens in the mouth, tinging the saliva red. Water and alcohol are both coloured by it, the latter dissolving about two-thirds of it; but it is insoluble in ether. It is only partially soluble in cold water, but more so in boiling water, which becomes turbid, and yields a deposit on cooling. The watery infusion is precipitated by the mineral acids and several other reagents. Kino contains a large quantity of modified tannin, catechine, extractive, red gum, &c.

East Indian Kino is regarded as the only genuine gum kino; but there is met with in commerce a substance called *Botany Bay Kino,* which is produced by *Eucalyptus resinfera* (*Myrtaceæ*), the Iron Bark, a native of Australia and Tasmania. Botany Bay Kino occurs in different forms, the tears varying in size and shape; when pure they are almost black in substance, but ruby-coloured in thin laminæ; the inferior kinds are duller from the presence of impurities. This kind is not officinal, but is used for the sake of its astringency, both in medicine and for tanning.

Butea frondosa, a tree of some size, inhabiting the mountainous parts of India, furnishes an astringent substance called *Butea Gum.* This resembles kino, and was formerly supposed to be the real gum. It is very like kino both in appearance and in medicinal properties, and is sometimes imported under that name. This also is used, for the sake of its astringency, both for medical purposes and for tanning.

TINCTURA KINO—TINCTURE OF KINO.—*Take of kino, in coarse powder,* 2 *ounces; rectified spirit,* 1 *pint. Macerate for seven days, in a closed vessel, with occasional agitation, filter, and add sufficient rectified spirit to make one pint.*

PULVIS KINO COMPOSITUS—COMPOUND POWDER OF KINO.—Synonym: *Pulvis Kino cum Opio,* 1864. *Take of kino, in powder,* $3\frac{3}{4}$ *ounces; opium, in powder,* $\frac{1}{4}$ *ounce; cinnamon bark, in powder,* 1 *ounce.*

Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.

Dose.—Of powdered kino, ten to thirty grains; of *Pulvis Kino Compositus*, five, ten, twenty, or thirty grains, according to circumstances (there is one grain of opium in twenty grains of the powder); of the tincture, thirty minims to two fluid drachms. The tincture is apt to become gelatinous when long kept, unless the air be completely excluded.

Kino is a less powerful astringent than catechu, but resembles it in its medicinal properties. It is used as a pure astringent in chronic diarrhœa and dysentery, in combination with chalk and opiates. It is also employed for the sake of its astringency in chronic mucous discharges, and also in passive hemorrhages. It has been found serviceable in pyrosis, and in some forms of dyspepsia. As a topical astringent it is used as a gargle or injection, and also as an application to flabby ulcers. It is given in cases associated with general debility, and is contra-indicated in inflammatory states.

Scoparii Cacumina—Broom Tops.—Officinal plant: *Sarothamnus scoparius*, Wimmer; *Diadelphia Decandria;* Common Broom. Illustration, plate 89, *Woodv. Med. Bot.* (*Spartium scoparium*). Officinal part: The tops, fresh and dried; from indigenous plants. Officinal preparations: *Decoctum Scoparii, Succus Scoparii.*

Botany.—A shrub, from three to eight feet high, with angular, unarmed branches. *Leaves*, ternate at the lower, and simple at the upper part; leaflets oblong. *Flowers*, large, yellow, axillary, solitary, stalked, papilionaceous. *Legume*, flat, compressed, dark brown, containing about fifteen seeds. *Habitat*, indigenous, dry sandy places throughout Europe. *Flowering time*, June.

CHARACTERS OF BROOM TOPS. — *Straight angular dark-green smooth tough twigs, of a bitter nauseous taste, and of a peculiar odour when bruised.*

Broom tops contain, besides other constituents, two peculiar substances obtained by Dr Stenhouse—one termed *Scoparin*, a neutral principle, which may be separated in yellow stellate crystals; the other a volatile liquid alkaloid, called *Spartia*, which is at first colourless, but assumes a brownish colour on exposure to light. Scoparin acts as a diuretic in repeated doses of about five grains, and does not produce injurious effects; but spartia produces powerful narcotic effects in small doses.

DECOCTUM SCOPARII—DECOCTION OF BROOM.—*Take of broom tops, dried,* 1 *ounce; distilled water,* 1 *pint. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.*

SUCCUS SCOPARII—JUICE OF BROOM.—*Take of fresh broom tops,* 7 *pounds; rectified spirit, a sufficiency. Bruise the broom tops in a stone*

mortar; press out the juice; and to every three measures of juice add one of the spirit. Set aside for seven days, and filter. Keep in a cool place.

Dose.—Of scoparin, five grains; of the decoction, two to four fluid ounces; of the juice, one to two fluid drachms.

Broom acts as a trustworthy diuretic, and its officinal preparations are used as vehicles for, or as adjuncts to enhance the activity of other remedies of a similar class. In large doses they act as emetics and purgatives. They are usually administered in dropsies, especially those of cardiac origin.

Glycyrrhizæ Radix—Liquorice Root.—Officinal plant: *Glycyrrhiza glabra*, Linn.; *Diadelphia Decandria;* Common Liquorice. Illustration, plate 134, *Steph. and Church. Med. Bot.* Officinal part: The root or underground stem, fresh and dried; cultivated in England. Officinal preparation: *Extractum Glycyrrhizæ.*

Botany.—*Root,* perennial, running to a considerable distance. *Stem,* herbaceous, erect, smooth, four to five feet high. *Leaves,* impari-pinnate; leaflets, about thirteen, oval, slightly emarginate, viscid underneath. *Flowers,* in axillary racemes, papilionaceous, distant, lilac, bluish, or purplish, in colour. *Legume,* compressed, smooth, three to four seeded. *Habitat,* south of Europe; cultivated at Mitcham, in Surrey.

CHARACTERS OF LIQUORICE ROOT.—*In long cylindrical branched pieces, an inch or less in diameter, tough and pliable; of a greyish-brown colour externally, yellow internally, without odour, of a sweet mucilaginous and slightly acrid taste. Digested with water it yields a solution which gives a precipitate with diluted sulphuric acid.*

Liquorice root, so called, is really an underground stem, and occurs in cylindrical pieces of about the thickness of the finger. Its chief constituents are *Glycyrrhizin,* which is a kind of uncrystallisable sugar, incapable of undergoing the vinous fermentation; it has the sweet taste of the root, and is soluble both in water and alcohol; and a *resinous oil,* which imparts to the root a slightly acrid taste. The root is difficult to preserve, and is generally in a dried and shrivelled state. It is best kept in dried sand.

EXTRACTUM GLYCYRRHIZÆ—EXTRACT OF LIQUORICE.—*Take of liquorice root, in coarse powder,* 1 *pound; distilled water,* 4 *pints. Macerate the liquorice root with two pints of the water for twelve hours, strain, and press; again macerate the pressed marc with the remainder of the water for six hours, strain, and press. Mix the strained liquors, heat them to* 212°, *and strain through flannel. Then evaporate by a water bath until the extract is of a suitable consistence for forming pills.*

This extract, when well prepared, is of a brown colour, and has the sweetness, without the acridity, of the root. Commercial extract of liquorice, called also *Liquorice Juice, Spanish* or *Italian Juice,* is usually met with in sticks more or less round, of a blackish colour. It is prepared in the south of Spain, in Italy, and in Sicily, from the roots of *Glycyrrhiza glabra* and *G. echinata.* It is frequently mixed with a

variety of substances, such as flour and starch, the most esteemed kind being that which is marked *Solazzi.* Pipe refined liquorice is made by dissolving the common extract of commerce, straining and re-evaporating it to a solid state, with the addition of gum or gelatine. This variety is subject to great adulteration, chiefly with flour, starch, and sugar. Pontefract cakes are made with refined liquorice. Decorticated liquorice powder is used for covering pills, to keep them from adhering to one another. Liquorice powder is frequently adulterated on the Continent with a pigment called French Yellow.

Dose, ad libitum.—Liquorice enters into the following officinal preparations :—*Decoctum Aloes Compositum, Confectio Sennæ, Trochisci Opii, Confectio Terebinthinæ, Decoctum Sarsæ Compositum, Infusum Lini, Pilula Hydrargyri, Pilula Ferri Iodidi,* and *Tinctura Aloes.*

Liquorice preparations act as emollients and demulcents, and are given in coughs and bronchial affections, as well as for the purpose of flavouring other medicines. The frequent use of the commercial extract of liquorice to allay cough deranges the digestive system and is highly injurious.

Tragacantha — Tragacanth.—Officinal plant: *Astragalus verus,* Olivier, Voy., DC., and possibly other species ; *Diadelphia Decandria.* Illustration, plate 329, *Nees Plant. Med.* Officinal part : A gummy exudation from the stem; collected in Asia Minor. Officinal preparations: *Pulvis Tragacanthæ Compositus, Mucilago Tragacanthæ.* Enters also into the preparation of *Pulvis Opii Compositus* and of *Confectio Opii.*

Botany.—A small shrub, the branches of which are covered with imbricated scales and spines, the remains of former petioles. *Leaflets,* eight or nine pairs, linear hispid. *Flowers,* yellow, axillary, in clusters of two to five. *Habitat,* Anatolia, Armenia, and Northern Persia.

CHARACTERS.— *White or yellowish, in broad shell-like slightly curved plates, tough and elastic, but rendered more pulverisable by a heat of* 120° *Fahr.; very sparingly soluble in cold water, but swelling into a gelatinous mass, which is tinged violet by tincture of iodine.*

PURITY TESTS.—*After maceration in cold water, the fluid portion is not precipitated by the addition of rectified spirit, and the gelatinous mass is not turned violet by tincture of iodine.*

According to some authorities, the best or white tragacanth is furnished by *Astragalus gummifer*, a native of Mount Lebanon and Kurdistan. Tragacanth exudes spontaneously from the stems of these and other plants, but only during the night, ceasing almost entirely soon after sunrise. Incisions are made in the stem in July and August to facilitate the exudation of the gum. The tragacanth thus collected is carried to Smyrna, whence—or from some other port in the Levant—it is imported into this country. The bulk of the tragacanth of commerce is obtained from the province of Anatolia, where also the best varieties of opium are produced. The whitest and cleanest kinds are obtained from the incisions, and when the weather is hot and dry; that which exudes spontaneously, especially if exposed to damp, is more or less brownish.

Tragacanth (sometimes called *gum dragon*) is met with in commerce in pieces of various shapes and sizes; sometimes in flattened plates, broad and thin, at others in tortuous, vermiform pieces. The flattened pieces are the best. It is white, yellowish, or yellowish-brown, inodorous, tasteless, hard, tough, and swells in water, forming a tenacious mucilage, which is tinged violet by tincture of iodine. Tragacanth is imported in chests and cases, and may be adulterated with the gum of other trees; if acacia gum were present, it would be detected by the first of the above tests, whilst the second test would detect the presence of too much starch. The chief constituents of tragacanth are *Tragacanthin* (adragantine or arabin), which is a soluble gum; and *Bassorin*, a gum which absorbs water and swells up, but is insoluble in it whether hot or cold. It is soluble in alcohol. Tragacanth also contains a little starch.

PULVIS TRAGACANTHÆ COMPOSITUS—COMPOUND POWDER OF TRAGACANTH.—*Take of tragacanth, in powder; gum acacia, in powder; starch, in powder, of each,* 1 *ounce; refined sugar, in powder,* 3 *ounces. Rub them well together.*

MUCILAGO TRAGACANTHÆ—MUCILAGE OF TRAGACANTH.—*Take of tragacanth, in powder,* 60 *grains; distilled water,* 10 *fluid ounces. To the water contained in a pint bottle, add the tragacanth; agitate briskly for a few minutes, and again at short intervals, until the tragacanth is perfectly diffused, and finally has formed a mucilage.*

Dose.—Of the compound powder, twenty to sixty or more grains.

Tragacanth and its preparations act as emollients and demulcents. They are chiefly used as vehicles for other medicines—the mucilage to suspend insoluble substances in mixtures, the compound powder as a vehicle for heavy active substances, such as calomel; but they may be given alone as demulcents and emollients in irritant poisoning, &c. The mucilage is used in the preparation of lozenges. Tragacanth makes a much thicker mucilage than gum arabic.

Indigo—Indigo, ($C_{16}H_5NO_2$, or C_8H_5NO), a blue pigment, prepared from various species of *Indigofera*, Linn. Indigo is placed in Appendix I. of the Pharmacopœia, and is used in the preparation of the test solution of sulphate of indigo. Indigo is obtained from several plants, but chiefly from those of the genus *Indigofera*, the indigo of commerce being for the most part derived from *Indigofera tinctoria*, which is largely cultivated for that purpose in India. Indigo is obtained by cutting down the young plants before flowering, and steeping them in vats of water, when their juices undergo fermentation; by this means a yellow liquid is obtained, from which—after it has been removed into other vats, well agitated, and exposed to the air, and acted upon by lime water—indigo is deposited in the form of a flocculent precipitate, or in large coagulated grains. It is then collected, cut whilst soft into cubical masses, and dried in a suitable apartment. Indigo appears to exist in the juices of the plant in the form of a colourless soluble compound, and indigo blue is not formed until the plant has been subjected to the above treatment;

it is therefore a product, and not an educt. Commercial indigo is generally met with in cubical pieces, which are of an intensely blue colour, more or less brittle and friable. When scratched it acquires a coppery red colour, and in this, as well as in affording a deep blue powder, it resembles Prussian blue, but may be distinguished from it by giving off, when heated to about 550°, a reddish violet vapour (*Indigotin*), which condenses in minute crystals. Indigo is nearly tasteless, has but little odour, and is insoluble in water, cold alcohol, ether, and oils, but is partially soluble in boiling alcohol. It is a compound of indigo red, indigo brown, and pure indigo blue or indigotin. Deoxidising agents, by removing the oxygen from it, destroy its colour, and convert it into *indigo white,* which, when exposed to the air, absorbs oxygen, and again becomes blue.

Indigo has been used medicinally. Its physiological action, when fully developed, is attended more or less with constriction and heat of the fauces, a metallic taste, nausea, vomiting, diarrhœa (with bluish or blackish liquid stools); the urine assumes a dark brown or violet colour, and, after long use, twitching of the muscles is observed. It has been chiefly recommended as a nervine tonic in spasmodic diseases, convulsions of children, epilepsy, chorea, hysteria, &c. It may be given, in doses of a few grains up to several drachms, as an electuary.

MUCUNA—Cowage, Cowhage, or Cowitch, and probably a corruption of *Kiwach,* the name of the plant as it is used in India. *Mucuna pruriens* of the West Indies, and *Mucuna prurita* of the East Indies, both furnish hairs from the pods, which are used in medicine under the above names. Mucuna was recognised in the three former pharmacopœias, and was referred to as the Fructus Pubes (L.), Hairs from the Pod (E.), and the Hairy Down (D.), of *Mucuna* or *Dolichos pruriens* of De Candolle, *Diadelphia Decandria,* inhabiting the West Indies. This plant is a twining shrub, stem herbaceous, leaflets ovate acute, inflorescence racemose, flowers with a disagreeable alliaceous odour, and parti-coloured, the vexillum or standard flesh-coloured, the alæ or wings either purple or violet, and the keel greenish-white. The legume, or siliqua hirsuta, is from three to five inches long, about the thickness of the finger, roundish, peculiarly curved, containing from four to six seeds, and covered with strong, bristling, stinging hairs. These hairs constitute the medicinal part of the plant, and when examined under the microscope, are seen to be finely pointed, and serrated towards their points. The pods are imported with the hairs attached, and both are of brown colour and stiff; but before they are ripe, when they are still soft and tender, the pods are used as an article of diet in India.

Cowhage is an example of a medicine acting purely mechanically. When the hairs are applied to the skin, they produce intolerable itching, and sometimes redness, swelling, and an eruption. Rubbing or scratching the part only renders their effects more severe; but the application of a little oil allays the irritation by protecting the parts, just as the mucus of the alimentary passages protects the mucous membranes from their irritating influence when the drug is given internally. The only medicinal use of cowhage is to act as a vermifuge, which it does by mechanically irritating the worms. It is most useful in dislodging the

round worm, *Ascaris lumbricoides,* but may also be given for the thread worm, *Ascaris vermicularis ;* it often fails to interfere with the tapeworm, *Tœnia,* for the removal of which other remedies are more efficient. Cowhage is usually a safe remedy, but severe enteritis has been known to follow its exhibition. The mode of administration is first to dip the pods into treacle or honey, and then to scrape the hairs from them into one or other of these substances as a vehicle, until it has the consistency of an electuary. Of this preparation, a teaspoonful to a tablespoonful—the former to a child, the latter to an adult—may be given before breakfast for two or three mornings, after which a brisk purgative must be administered to carry off the worms. A decoction of the legumes was formerly used as a diuretic in dropsies.

PHYSOSTIGMATIS FABA—CALABAR BEAN.—Eséré-Nut, or Ordeal-Bean of Old Calabar ; the seed of *Physostigma venenosum,* Balfour. *Trans. Royal Soc. Edin.,* vol. xxii., page 305. Imported from Western Africa. The plant belongs to the sub-order *Papilionaceœ* and tribe *Phaseoleœ.*

In Calabar, as in many countries not yet withdrawn from the darkness of heathen superstition, those events which cast a shadow across the pathway of human life, such as sickness and death, are invariably attributed to the malignancy of personal hatred, operating through the intervention of the *ifod* or native witchcraft. Hence the disconsolate, instead of accepting their condition with resignation, and acknowledging it as the benignant chastisement of a supreme and loving Father, thirst for retribution, and by a method as absurd as it is unjust, imperil, and but too commonly destroy, the lives of their fellow-creatures ; and this by a law which is sanctioned by the State, and administered under the superintendence of its highest functionaries. When an individual dies, whether the cause be apparent or obscure, it generally follows that a victim is pointed at with the finger of suspicion, as guilty, by witchcraft, of murder ; whereupon he, or she, is either publicly charged with the crime, or the accused demands an opportunity of freeing himself, or herself, from the imputation.

The manner in which the trial is conducted may be thus briefly stated. A person lays a charge against another before one of the chiefs of a village, a council of neighbouring chiefs is summoned, the accusation is heard, and the accused is then allowed to choose a line of defence, which is invariably an appeal to the ordeal-bean or "chop-nut," as it is called. This being granted, each chief puts down an Eséré on the ground, and the accused party takes them up one by one, chews, and swallows them. Sometimes as many as twenty or thirty are thus taken. If he vomits, he is innocent ; if he dies, guilty. The trial takes place before a public assembly, the priest or fetish-man rules the proceedings, and it is left to his discretion to interfere, when he deems that justice has been satisfied, in cases in which neither vomiting nor death determines the issue. Sometimes only a part of one bean is eaten, sometimes as many as twenty or thirty beans, or it may be given in the form of infusion. It is generally believed that the prejudices of the priest materially influence the result, for it is supposed that he can arrange beforehand so as to administer a more or less poisonous bean—that is, one in its natural state, or one that has been tampered with—according as he wishes the party to

live or die. The only safeguard against a greater abuse of this method of judicial investigation, lies in the privilege of the accused, should he escape death, to demand that his accuser be put through the ordeal.

But the ordeal-bean has at length assumed a nobler office as a remedial agent, the effects of which have been investigated by many physicians, and especially by Professor Christison, Dr Fraser, and Dr Argyll Robertson of this city.

The plant from which the bean is derived constitutes a new and distinct genus, of which it is the only known species. After a careful examination of it, Professor Balfour was induced to name the genus *Physostigma* (φυσάειν to inflate, and στίγμα) in consequence of the remarkable crescentic or hooded appendage of the stigma, and the species *venenosum,* in allusion to its poisonous qualities. The following is an abridgment of Professor Balfour's description of the plant :—

Botany.—A large twining plant, twining from right to left. *Root,* spreading, with numerous fibrils, often having small succulent white tubers attached. *Stem,* about two inches in diameter at its thickest part, sometimes attaining a length of fifty feet, cylindrical, of a brown-grey colour, roughish ; younger branches of a dark-green colour, thickened at the nodes ; branches twisting on themselves, and round those in their vicinity ; wood of the stem very porous, giving out, when cut, a pretty free stream of limpid fluid, which is slightly astringent and acrid. *Leaves,* alternate, petiolate, stipulate, pinnately-trifoliate ; leaflets ovate, acuminate. *Inflorescence,* axillary or pendulous multifloral racemes ; flowers about an inch in length, half-an-inch across. *Calyx,* campanulate, four cleft at its apex. *Corolla,* papilionaceous, beautifully veined, of a pale pink colour, with purplish tinge. *Stamens,* ten, diadelphous. *Pistil,* more than one and a-half inch long ; ovary stipulate, rough on the surface, not hairy ; style curved, smooth except below the stigma, where the concavity is covered with a continuous line of hairs, which give a marked barbate appearance ; stigma blunt, covered by a remarkable ventricular sac or hood, which extends along the upper part of the convexity of the style. *Ovules,* two or three. *Legume,* in the young state green, and somewhat falciform, afterwards becoming dark-brown and straight ; sutures slightly prominent, ventral one grooved, interior lined with white loose pith-like cellular tissue, in which the ovules are imbedded, and by which they are separated from each other. Full-grown legume, about seven inches in length, elliptico-oblong, dehiscent. The officinal preparations are the powdered seeds and an extract.

CHARACTERS OF THE SEEDS.—*About the size of a very large horse-bean, with a very firm, hard, brittle, shining integument of a brownish-red, pale-chocolate, or ash-grey colour. Irregularly kidney-shaped, with two flat sides, and a furrow running longitudinally along its convex margin, ending in an aperture near one end of the seed. Within the shell is a kernel consisting of two cotyledons, weighing on an average about forty-six grains, hard, white, and pulverisable, of a taste like that of the ordinary edible leguminous seeds, without bitterness, acrimony, or aromatic flavour. It yields its virtues to alcohol and imperfectly to water.*

EXTRACTUM PHYSOSTIGMATIS—EXTRACT OF CALABAR BEAN. —*Take of Calabar bean, in coarse powder,* 1 *pound*; *rectified spirit,* 4 *pints. Macerate the bean for forty-eight hours with one pint of the spirit in a*

close vessel, agitating occasionally, then transfer to a percolator, and when the fluid ceases to pass, add the remainder of the spirit so that it may slowly percolate through the powder. Subject the residue of the bean to pressure, adding the pressed liquid to the product of the percolation; filter, distil off most of the spirit, and evaporate what is left in the retort by a water-bath to the consistence of a soft extract.

Notwithstanding the extremely poisonous character of the bean, it is subject to the attack of an insect, the offspring of which is developed within the spermoderm, and at the expense of the kernel; hence the beans are occasionally met with in a perforated condition. The Calabar bean contains, with other constituents, an extremely poisonous alkaloid, eseria, which is soluble in alcohol.

Professor Christison was the first to give an account of the physiological effects of the Calabar bean in the human subject, and he bought his experience by an experiment upon himself. Having swallowed twelve grains of the bean on getting up in the morning, he describes the following consequences :—"A slight giddiness, which occurred in fifteen minutes, was ascribed to the force of the imagination; and I proceeded to take a warm shower-bath, which process, with the subsequent scrubbing, might take up five or six minutes more. The giddiness was then very decided, and was attended with the peculiar indescribable torpidity over the whole frame which attends the action of Opium and Indian hemp in medicinal doses. Being now quite satisfied that I had got hold of a very energetic poison, I took immediate means for getting quit of it, by swallowing the shaving water I had just been using, by which the stomach was effectually emptied. Nevertheless, I presently became so giddy, weak, and faint, that I was glad to lie down supine in bed. The faintness continuing great, but without any uneasy feeling, I rung for my son, told him distinctly my state, the cause, and my remedy, that I had no feeling of alarm, but that for his satisfaction he had better send for a medical friend. Dr Simpson, who was the nearest, reached me in a few minutes, within forty minutes after I ate the seed, and found me very prostrate and pale, the heart and pulse extremely feeble, and tumultuously irregular; my condition altogether very like that induced by profuse flooding after delivery, but my mental faculties quite entire, and my only sensation that of extreme faintness, not, however, unpleasant. Dr Simpson judged it right to proceed at once for Dr Douglas Maclagan as a toxicological authority, and returned with him in a very few minutes. In his absence, feeling sick, I tried to raise myself on my elbow to vomit, but failed; I made a second more vigorous effort, but scarcely moved. At once it struck me, 'This is not debility, but volition is inoperative.' In a third effort, I was more nearly successful; and in the fourth, a resolute exercise of the will, I did succeed. But I could not vomit. The abdominal muscles acted too feebly, nor were they much aided by a voluntary effort to make them act. I then gave up the attempt, and fell back, comforting myself with the reflection that vomiting was unnecessary, as the stomach had been thoroughly cleared. At the same time the sickness ceased, and it never returned. There were now slight twitches across the pectoral muscles. I also felt a sluggishness of articulation; and to avoid any show of this, made a strong effort of the will to speak slowly and firmly, through fear of alarming my son, who was

alone with me. Dr Maclagan, on his arrival, thought my state very like the effects of an over-dose of aconite. Like Dr Simpson, he found the pulse and action of the heart very feeble, frequent, and most irregular, the countenance very pale, the prostration great, the mental faculties unimpaired, unless perhaps it might be that I felt no alarm, where my friends saw some reason for it. I had, in fact, no uneasy feeling of any kind, no numbness, no prickling, not even any sense of suffering from the great faintness of the heart's action ; and as for alarm, though conscious I had got more than I had counted on, I could also calculate, that if six grains [which Professor Christison had taken after supper the previous night, and were not removed by vomiting] had no effect [or at most, a certain pleasant feeling of slight numbness in the limbs, like that which precedes the sleep caused by opium or morphia], twelve could not be deadly, when the stomach had been so well cleared out. Presently my limbs became chill, with a vague feeling of discomfort. But warmth to the feet relieved this, and a sinapism over the whole abdomen was peculiarly grateful when it began to act. Soon afterwards the pulse improved in volume, but not in regularity. I was now able to turn in bed, and happening to get on the left side, my attention was for the first time directed to the extremely tumultuous action of the heart, which compelled me to turn again on the back, to escape the strange sensation. Two hours after the poison was swallowed, I became drowsy, and slept for two hours more; but the mind was so active all the while, that I was not conscious of having been asleep. On awaking, the tumultuous action of the heart continued. In an hour more, however, I took a cup of strong coffee, after which I speedily felt an indefinable change within me ; and on examining the condition of the heart, I found it had become perfectly and permanently regular. For the rest of the forenoon, I felt too weak to care to leave my bed ; and on getting up after a tolerable dinner, I was so giddy as to be glad to betake myself to the sofa for the evening. Next morning, after a sound sleep, I was quite well."

But to Dr Thos. R. Fraser is due the credit of investigating most thoroughly the properties of the Calabar Bean. The following are the results of poisonous doses of the bean, as observed by Dr Fraser in his experiments on the lower animals :—

"When a *small* fatal dose is administered to one of the lower animals, a train of symptoms is produced usually in the following order:—A slight tremor is first seen, especially at the posterior regions, and this extends forwards to the anterior extremities and the head. The limbs yield immediately afterwards, the posterior becoming generally first paralysed, and the animal lies extended in a state of almost complete muscular flaccidity. A few attempts may be made to recover the normal position, but they are usually ineffectual. The bowels, in most cases, are evacuated, and urine is passed. The pupils generally *contract;* as the symptoms advance, the respiration becomes slow and irregular, with a distinct stertor accompanying both inspiration and expiration, and frothy mucus escapes from the mouth. Muscular twitches occur, and often continue after respiration has ceased. Reflex action cannot be produced by either pinching or pricking the skin. By-and-by the eye-lids do not contract when touched or even when the eyeball is pricked. On lifting by the ears, the limbs hang inertly, and the only sign of life is an occasional gasping inspiration, which also soon ceases, and the animal appears dead.

"Consciousness is preserved during the whole time, until the power of expression is lost. During incomplete paralysis, proofs of sensation may be obtained by pinching the ears or pricking the skin. Immediately after death the pupils dilate.

"On opening the body the various muscles which are cut contract. The diaphragm and muscles of the extremities may be excited to action by pinching the phrenic and sciatic nerves, and the contractility of the muscles generally is retained for some time after death. The heart is found acting regularly, and the intestines exhibit distinct vermicular action. The heart may continue its action for one hour and a-half after death. Its chambers usually cease to contract in a definite order, the left auricle first losing its spontaneous action, then the right and left ventricles, and, after an interval, the right auricle. The large veins in the thorax are found distended. The lungs are engorged—in two experiments this had proceeded to such an extent that detached portions sank in water.

"When a *large* fatal dose of the kernel is administered, the hind limbs almost immediately yield, and the animal falls. It lies flaccid, and in any position, on the table, and exhibits muscular power only by a few twitches. The pupils contract; in a few cases fluid escapes from the nostrils and mouth, and the lachrymal secretion is increased. Reflex action cannot be produced by irritation, and the respirations, after a few gasps, cease.

"The pupils dilate immediately after death. On opening the body, muscular twitches occur. The heart is found distended and passive; irritation, however, produces contraction for about ten minutes after death. The vermicular action of the intestines is very much diminished, and can scarcely be observed. The mesenteric arteries and veins may be readily distinguished by the colours of their contents."

Dr Fraser's principal results regarding the nature of the physiological action of the bean may be thus summarised:—

1. The Calabar Bean, when acting as a poison, may produce death either, 1*st*, by paralysis of respiration—*Asphyxia;* or, 2*d*, by first diminishing the frequency of the heart's action, and then finally stopping its contractions—*Syncope.*

2. The paralysis resulting seems to be due to an action upon the spinal cord as a *reflex centre,* and not to be owing to any effect either upon the spinal nerves or the cerebrum.

3. Its cardiac effect is most probably due, not to any increase of the inhibitory power of the vagus, but to its paralysing the exciting ganglia of the heart.

4. Physostigma, however, after a time paralyses the motor or efferent spinal nerves, its action in so doing commencing in their peripheral extremities, like conium and curare. It does not seem to exert any paralytic action upon afferent or sensory nerves.

5. The effect on the smaller blood-vessels is, first, contraction, and afterwards dilatation. Large doses at once arrest cardiac movements; smaller doses make them grow less quickly feeble. Immediately after the administration of the poison, there usually occurs a slight fall in the arterial tension. This is followed by a distinct rise in both arterial and venous pressure, but subsequently a rapid diminution of pressure in both arterial and venous systems supervenes.

6. The pupil is found alternately to dilate and contract. At the moment of death it is found contracted, but immediately afterwards it is found to dilate.

Locally, Calabar bean destroys the contractility of striped and non-striped muscles. It paralyses first afferent then efferent nerves. Applied to the eyeball, it produces a somewhat painful sensation of tension in the ciliary region, contraction of the pupil, myopia and astigmatism, with frequently congestion of the conjunctival vessels, pain in the supra-orbital region, and twitches of the orbicularis palpebrarum muscle.

The cases in which Dr Fraser found the Calabar bean useful as a therapeutic agent were erysipelas, delirium tremens, febricula, acute bronchitis, rheumatic fever, various neuralgic affections, and irritable stomach. It is contra-indicated in asthenic cases, in debilitated persons, and when the pulse is feeble. It has also been found useful in tetanus, as an antidote in poisoning by strychnia, in epilepsy, chorea, &c.

But it is chiefly used as a topical agent in ophthalmic surgery. In 1856, Van Hassalt found contraction of the pupil to follow the internal administration of the bean; whilst Dr Fraser, in 1862, showed that its local application was sufficient to induce this condition. In 1863, my friend Dr Argyll Robertson, to whom I am indebted for notes on the application of this agent to ophthalmic surgery, further pointed out that the local application of this remedy induced spasm of the accommodation of the eye, as well as contraction of the pupil, and was capable of counteracting or modifying the dilatation of pupil and paralysis of accommodation, resulting from the application of belladonna or atropine to the eye. Mr Bowman further observed a degree of astigmatism, or irregular refraction of the media of the eye, as one of the symptoms.

The following are the effects observed upon the application of a drop of a moderately strong solution of the spirituous extract of the Calabar bean to the conjunctiva of the eye. In the course of about ten minutes the accommodation of the eye becomes affected; objects beyond a few inches from the eye appear dim, enlarged, and closer to the eye, while upon the use of a suitable concave glass these symptoms disappear,—in fact, a condition of short-sightedness results. At the same time, a sensation of straining is felt in the eye, similar to that experienced after a prolonged near inspection of fine objects. After a short interval the pupil becomes contracted, and this may reach to such an extent that the pupil does not measure above one-third of a line in diameter. As a consequence of this contraction, less light is admitted to the retina, and objects

appear darker than natural, while the pupil of the other eye becomes sympathetically somewhat dilated. As the effects pass off, the affection of the accommodation gradually returns to its normal state, and, secondarily, the pupil dilates, and in the course of about twenty-four hours the eye has returned to its natural condition.

The local employment of this agent is beneficial,—*1st*, In cases of paralysis of the circular fibres of the iris and of the accommodation, such as are apt to follow exposure to cold, or to occur in the course of diphtheria, continued fever, or other debilitating diseases. *2nd*, To counteract the effects of atropine or belladonna on the eye. *3rd*, To diminish the amount of light admitted to the eye in cases of acute inflammation of the choroid or retina ; and, *4th*, In cases of penetrating ulcers or wounds at the peripheral part of the cornea, with the view of preventing or reducing prolapse of the iris.

Dose.—Of the powder, beginning with one grain, and cautiously increasing the dose to three, or at most four grains ; of the extract, one-sixteenth to one-fourth of a grain ; of an alcoholic tincture, according to strength. For local application, a solution of the spirituous extract of the bean in glycerine, of such a strength that one minim contains the active ingredients of four grains of the bean, is that most generally employed. A preparation termed *Calabarised gelatine* is a very convenient and portable form. It consists of thin sheets of gelatine saturated with a spirituous solution of the bean, and marked out into small squares, or cut into minute discs, each of which is sufficient for a single application. They are to be applied, by means of a fine moistened camel's-hair pencil, to the conjunctiva, where they are dissolved by the tears, and produce their due effect.

Antidotes.—Emetics to empty the stomach thoroughly and promptly ; followed by strong coffee and diffusible stimulants. From certain experiments made by Dr Fraser, he has been led to believe that atropia is a physiological antidote against poisoning with Calabar bean. The researches of a committee appointed by the British Medical Association of 1869 appear to indicate that, though the atropia undoubtedly exerts a modifying influence over the symptoms produced by the bean, it is not an antidote against a poisonous dose, and therefore could not be depended upon in practice. They have found, however, that the hydrate of chloral has saved the lives of several rabbits to which a fatal dose of the bean had been administered.

Sub-order 2. *Cæsalpinieæ* — the Senna Section.—The plants of this sub-order are chiefly characterised by their purgative and dyeing properties.

Senna—1. Senna Alexandrina, Alexandrian Senna.—Officinal plants : *Cassia lanceolata,* Lamarck ; *Ency.*, plate 345, *Nees, Plant. Med. ;* and *Cassia obovata,* Colladon, plates 347 and 348 (*C. senna*), *Nees, Plant. Med. ; Decandria Monogynia.* Officinal part : The leaves ; imported from Alexandria, carefully freed from the flowers, pods, and

leaf-stalks of the same, and from the leaves, flowers, and fruit of *Solenostemma Arghel*, Heyne.

2. Senna Indica—Tinnivelly Senna.—Officinal plant: *Cassia elongata*, Lemaire. Illustration, plate 37, *Royle, Bot. Himal.* Officinal part: The leaves, from plants cultivated in Southern India. Officinal preparations of senna: *Confectio Sennæ, Infusum Sennæ, Mistura Sennæ Composita, Syrupus Sennæ, Tinctura Sennæ.*

Botany.—Generic characters, shrubs or herbs, either annual or perennial; leaves simply and abruptly pinnate, oblique at the base; leaflets opposite; petioles frequently glanduliferous; legume flat, membranous, in some instances curved, in others nearly straight. *Cassia lanceolata*, a bushy, very leafy, annual, two to three feet in height. *Stem*, suffructicose, erect, round, smooth. *Leaves*, alternate, abruptly pinnate, petiole glandless; leaflets five to eight pairs, with short petioles, ovate-acute and lanceolate-acute. *Flowers*, in axillary terminal racemes, yellow. *Legumes*, pendulous, flat, slightly enlarged over the seeds, upper margins a little curved, brown, containing five to eight seeds. *Seeds*, rugose, white. *Habitat*, Egypt, in the valleys of the desert to the south and east of Syene or Assouan, where it is collected, and purchased by merchants who bring it to Cairo. It constitutes upwards of three-fifths of Alexandrian senna. *Cassia obovata*, a diffuse perennial herb. *Leaves*, equally pinnate, smooth, petiole glandless; leaflets four to six pairs, obovate, obtuse, slightly mucronate, unequal at the base; stipules somewhat stiff and spreading. *Flowers*, in racemes, yellow. *Legumes*, broad, membranous, smooth, rounded at each end, with an elevated crest, forming an interrupted ridge along the middle of each valve. *Seeds*, six to eight, wedge-shaped, rugose. *Habitat*, Egypt, Nubia, Desert of Suez, Syria, India. *Cassia elongata*, an annual. *Stem*, erect, smooth. *Leaves*, narrow, equally pinnate, petioles glandless; leaflets, four to eight pairs, lanceolate, nearly sessile; stipules spreading, minute. *Flowers*, in axillary, terminal racemes, bright yellow. *Legumes*, pendulous, oblong, membranous. *Seeds*, many, deep-brown. Cultivated in India.

Characters of Alexandrian Senna.—*Lanceolate, or obovate leaflets, about an inch long, unequally oblique at the base, brittle, greyish-green, of a faint peculiar odour, and mucilaginous sweetish taste.*

Purity Tests.—*The unequally oblique base, and freedom from bitterness, distinguish the senna from the arghel leaves, which are also thicker and stiffer.*

Characters of Tinnivelly Senna.—*About two inches long, lanceolate, acute, unequally oblique at the base, flexible, entire, green, without any admixture; odour and taste those of Alexandrian senna.*

There are several varieties of senna met with in commerce, which are distinguished either by the names of the countries where they are produced, or by the names of the places whence they are imported. *Alexandrian Senna* is imported from Alexandria in bales. It is collected in Nubia and Upper Egypt, whence it is carried down the Nile to Boulak, the great Egyptian depôt. It is subject to adulteration, but the true lanceolate or obovate leaflets, when carefully picked, are highly esteemed. Formerly this variety of senna was purposely adul-

terated with the leaves of *Solenostemma* (*Cynanchum*) *Arghel* and *Tephrosia Apollinea*, and on the Continent with *Colutea arborescens*, and *Coriaria myrtifolia*, but this sophistication is not so common now. The leaflets should be of a pale or greyish-green colour, have an insipid, unpleasant taste, and an odour somewhat resembling tea; they should also be free from stalks and fruits of their own and the other plants. *Indian Senna* may be divided into the Tinnivelly, Saharumpore, and the Madras kinds. *Tinnivelly Senna* was probably transplanted from Arabia. It is usually an esteemed variety; the leaflets are thin, large, and of a lively green colour, lanceolate, and one to two inches long. It loses weight considerably on drying, and is described as having an acetous odour, as if having undergone the acetous fermentation while drying. It is largely used in this country. *Saharumpore Senna* is the same variety as the last, but from growing in a more northerly latitude, its leaflets are smaller. *Madras Senna* is also a variety of Tinnivelly Senna, but not so carefully cultivated or prepared as that from Tinnivelly itself. *African*, *Arabian*, *Common East Indian*, or *Bombay Senna*, is first conveyed from Arabia to Bombay, whence it is imported into this country, where it is largely used. The leaves are from an inch to an inch and a-half long, thin, and lanceolate, narrower than the varieties already mentioned, but usually entire. This variety is not generally well picked, but when it is so it is of considerable commercial and medicinal value. *Tripoli Senna* resembles Alexandrian. It is conveyed in caravans from Fezzan to Tripoli, and is a pure variety, but is usually received much broken and destroyed, and is hence less esteemed. The leaflets are smaller, thinner, greener, and less acute than those of Alexandrian senna. *Aleppo Senna* is produced by *Cassia obovata*; it is seldom met with now. *Senegal Senna* is said to be a bluish-leaved senna, the leaflets being rougher and more glaucous than those of *Cassia obovata*. *Mecca Senna* is one of the varieties first carried to India and then imported into this country. *American Senna*, produced by *Cassia marilandica*, is not an article of commerce in this country; the leaflets are oblong, lanceolate, one and a-half to two inches long, and a quarter to half-an-inch broad.

Senna leaves should be free from stalks, broken pieces of pod, dust, dirt, date stones, and the leaves, leaf-stalks, and fruit of other plants. The leaves of *Solenostemma Arghel* may be known by their thick, leathery consistence, their paler colour, their lanceolate shape, and by being equal at the base; they act as cathartics, but are inferior to senna. The leaves of *Tephrosia Apollinea* are recognisable by being obovate and downy, and also by the veins running parallel to each other, from the midrib to the margin of the leaflet, without ramifying. The leaves of *Colutea arborescens*, or bladder senna, are equal at the base. The leaves of *Coriaria myrtifolia* may be distinguished—whenever the entire leaf can be obtained, which is rare—by having on each side of the midrib a strong lateral longitudinal nerve, and also by their astringency. This plant has poisonous properties, and its leaves have produced narcotic effects when mixed with senna.

Senna consists chiefly of cathartin, carthagenic acid, yellow colouring matter, volatile oil, fixed oil, albumen, mucus, malic acid, malate, and tartrate of lime, acetate of potash, mineral salts, lignin, &c. The odor-

ous principle of senna may be obtained by distilling the leaves with water; it has a disagreeable odour and taste. Cathartogenic acid is now known to be the purgative element in senna. It is a glycoside, and is stated to have the formula $C_{180}\ H^{192}N_4SO_2$. It is extremely unstable. It is insoluble in water, strong alcohol, and ether, but its alkaline and earthy salts are readily soluble. Boiled with a mineral acid it splits up into a peculiar kind of glucose and an acid called cathartogenic. The cathartate of ammonium acts as a slow but certain purgative, in doses of $3\frac{3}{4}$ grains, occasioning at the same time considerable griping. In doses of $7\frac{1}{2}$ grains it acts as a violent purge, producing much griping and sickness.

CONFECTIO SENNÆ—Confection of Senna.—(Lenitive Electuary).—*Take of senna, in fine powder*, 7 *ounces; coriander fruit, in fine powder*, 3 *ounces; figs*, 12 *ounces; tamarind*, 9 *ounces; cassia pulp*, 9 *ounces; prunes*, 6 *ounces; extract of liquorice*, $\frac{3}{4}$ *ounce; refined sugar*, 30 *ounces; distilled water, a sufficiency. Boil the figs and prunes gently with twenty-four ounces of distilled water in a covered vessel for four hours, then, having added more distilled water to make up the quantity to its original volume, mix the tamarind and cassia pulp, digest for two hours, and rub the softened pulp of the fruits through a hair sieve, rejecting the seeds and other hard parts. To the pulped product add the sugar and extract of liquorice, and dissolve them with a gentle heat; while the mixture is still warm, add to it gradually the mixed senna and coriander powders, and mix the whole thoroughly, making the weight of the resulting confection seventy five ounces, either by evaporation or by the addition of more distilled water.*

INFUSUM SENNÆ—Infusion of Senna.—*Take of senna*, 1 *ounce; ginger, sliced*, 30 *grains; boiling distilled water*, 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain.*

SYRUPUS SENNÆ—Syrup of Senna.—*Take of senna, broken small*, 16 *ounces; oil of coriander*, 3 *minims; refined sugar*, 24 *ounces; distilled water*, 5 *pints, or a sufficiency: rectified spirit*, 2 *fluid ounces. Digest the senna in seventy ounces of the water for twenty-four hours at a temperature of* 120°*; press out the liquor and strain it. Digest the marc in thirty ounces of the water for six hours at the same temperature; again press out the liquor and strain it. Evaporate the mixed liquors in a water-bath to ten fluid ounces, and, when cold, add the rectified spirit, previously mixed with the oil of coriander. Clarify by filtration, and wash what remains on the filter with distilled water, until the washings make up the filtrate to sixteen fluid ounces. Then add the sugar, and dissolve by means of a gentle heat. The product should weigh two pounds ten ounces, and should have the specific gravity* 1·310.

MISTURA SENNÆ COMPOSITA — Compound Mixture of Senna—(Black draught).—*Take of sulphate of magnesia*, 4 *ounces; extract of liquorice*, $\frac{1}{2}$ *ounce; tincture of senna*, $2\frac{1}{2}$ *fluid ounces; compound tincture of cardamons*, 10 *fluid drachms: infusion of senna, a sufficiency. Dissolve the sulphate of magnesia and extract of liquorice in fourteen fluid ounces of the infusion of senna, with the aid of a gentle heat, then add the tinctures, and sufficient infusion of senna to make one pint.*

TINCTURA SENNÆ—Tincture of Senna.—*Take of senna, broken small*, $2\frac{1}{2}$ *ounces; raisins, freed from seeds*, 2 *ounces; caraway fruit,*

bruised; coriander fruit, bruised, of each, ½ ounce; proof spirit, 1 pint. Macerate the solid ingredients for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—Of the confection, sixty grains to half-an-ounce; of the infusion, one to two fluid ounces; of the compound mixture, one to one and a-half fluid ounce. Of the syrup, one to two or more fluid drachms for a child, or as an adjunct to purgative mixtures; of the tincture, one to two fluid drachms as an adjunct to purgative mixtures, when it acts as a carminative and stimulant, as well as a purgative; or in larger doses of two to four fluid drachms as a cordial and stimulant cathartic.

Senna acts as a safe, energetic, and somewhat stimulant purgative, but is apt to produce the disagreeable consequences of nausea, griping, and flatulence; it is, however, seldom given alone, and by a judicious combination with carminatives, these unpleasant effects may be controlled. It operates chiefly upon the *small intestines*, causing copious watery evacuations; it is a mild, drastic purgative, but, unlike most medicines of that class, it is not poisonous in large doses. It probably stimulates the abdominal and pelvic vessels, thereby increasing catamenial and hemorrhoidal discharges. As an active purge it is useful in constipation, especially in head cases, as it is somewhat of an irritant and derivative. It is better adapted to persons of leuco-phlegmatic than to those of nervous temperament. It is contra-indicated in menorrhagia, threatening abortion, in certain conditions of the uterus and rectum tending to prolapsus, and in inflammatory affections of the stomach and bowels. In most other cases it is a safe and useful remedy for persons of all ages. The infusion is a suitable vehicle for saline purgatives. Senna is sometimes given with bohea tea or with coffee, the *Café au Séné* of the French, to render it more palatable.

Cassiæ Pulpa—Cassia Pulp.—Officinal plant: *Cassia Fistula*, Linn.; *Decandria Monogynia*, Purging Cassia. Illustration, plate 163, *Woodv. Med. Bot.* Officinal part: The pulp of the pods: imported from the East Indies, or recently extracted from pods imported from the East or West Indies. Officinal preparation: Enters into *Confectio Sennæ*.

Botany.—A showy tree, twenty to thirty feet high. *Leaves*, twelve to eighteen inches long, alternate, pinnate; leaflets, four to eight pairs, opposite, ovate, somewhat pointed; petioles glandless, stipules minute. *Flowers*, large, bright yellow; racemes, one to two feet long, pendulous, without bracts, smooth. *Legume*, cylindrical, ligneous, one to two feet long, smooth, somewhat obtuse, indehiscent, blackish-brown ex-

ternally, and marked with three longitudinal bands extending the whole length of the legume, two of them being together on one side, and the third on the opposite side. Internally, the legume is divided into numerous spurious cells by thin transverse partitions, phragmata, or dissepiments. Each cell contains a single seed, which is surrounded by a soft, blackish-coloured pulp. *Habitat*, India and Egypt, and it has been carried to the West Indies.

CHARACTERS.—*Blackish brown, viscid, sweet in taste, and somewhat sickly in odour; usually containing the seeds and dissepiments.*

Cassia Fistula is quite distinct from the cassia produced by the Laurel tribe, though the names are often confounded. The pulp of the pod is of a reddish-black or blackish-brown colour, and has a sweetish taste. When exposed to the atmosphere it undergoes the acetous fermentation, and becomes acid. The West Indian variety usually contains most pulp, and is therefore more esteemed. The pods which are heavy, the seeds of which do not rattle when shaken, are the best.

Cassia pulp in small doses is laxative, in larger doses purgative, often causing nausea, griping, and flatulence. It is rarely used alone, but may be given in doses of sixty to one hundred and twenty or more grains, to children, and in larger doses to adults, as a laxative in febrile and inflammatory cases.

Hæmatoxyli Lignum—Logwood.—Officinal plant: *Hæmatoxylum campechianum*, Linn.; *Decandria Monogynia;* the Logwood Tree. Illustration, plate 17, *Woodv. Med. Bot.* Officinal part: The heart-wood sliced; imported from Campeachy, in Central America, from Honduras and Jamaica. Officinal preparations: *Decoctum Hæmatoxyli, Extractum Hæmatoxyli.*

Botany.—A tree from forty to fifty feet in height, with the stem generally crooked. *Leaves*, pinnate; leaflets, two to four pairs, obovate or obcordate. *Flowers*, yellow, short stalked, in racemes. *Legume*, small, compressed, lanceolate, pointed at each end, one-celled, two-seeded. *Habitat*, Campeachy; met with in West Indies and in India.

CHARACTERS.—*The logs are externally of a dark colour, internally they are reddish-brown; the chips have a feeble agreeable odour, and a sweetish taste; a small portion chewed imparts to the saliva a dark pink colour.*

The wood is imported from Campeachy, Honduras, and Jamaica, in logs of various sizes. The bark and the sap-wood, which is light-coloured, are removed before importation, so that only the red heart-wood, or duramen, comes to this country, where it is chiefly used by dyers. Externally, the logs are of dark colour; internally, they are reddish-brown. The wood is dense and hard, has a sweetish taste, an agreeable odour, and receives a rich polish. The finest variety comes from Campeachy, and is called "Laguna" from the name of the place where it is shipped. Some small, selected pieces are called "Oporto wood," from the circumstance of their being carried there for the purpose of colouring wine. Logwood contains volatile oil, tannin, resinous matter, glutinous matter, acetic acid, hæmatin, and various salts.

Hæmatin, or hæmatoxylin, occurs as a red crystalline substance, slightly bitter and astringent, soluble in alcohol and in ether, and slightly so in water; it is often found in large red crystals in the fissures of the wood.

DECOCTUM HÆMATOXYLI—DECOCTION OF LOGWOOD.—*Take of logwood, in chips,* 1 *ounce; cinnamon bark, in coarse powder,* 60 *grains; distilled water,* 1 *pint. Boil the logwood in the water for ten minutes, in a covered vessel, adding the cinnamon towards the end. Strain the decoction, and pour as much distilled water over the contents of the strainer as will make the strained product measure one pint.*

EXTRACTUM HÆMATOXYLI—EXTRACT OF LOGWOOD.—*Take of logwood, in fine chips,* 1 *pound; boiling distilled water,* 1 *gallon. Infuse the logwood in the water for twenty-four hours, then boil down to one-half, strain, and evaporate to dryness by a water-bath, stirring with a wooden spatula. Iron vessels should not be used.*

Dose.—Of the infusion, one or two fluid drachms to one or two fluid ounces, according to age; of the extract, ten to thirty grains, in pills or solution. The extract becomes exceedingly hard when kept, so much so that pills made with it are said to have passed through the alimentary canal untouched.

Logwood acts as an astringent, but not of such power as to cause constipation, or materially to derange the digestive system. From the absorption of its colouring matter the urine is tinged. One or two cases are recorded in which the use of logwood, to check old-standing diarrhœa, has been followed by a smart attack of phlebitis. The ordinary uses of hæmatoxylum are those of an astringent, in chronic diarrhœa and dysentery, in hemorrhages, in hyper-mucus secretions, &c. It has the advantage as a remedy in the diarrhœa of children of not causing subsequent constipation. It has been recommended for the purpose of arresting the sweating of phthisis, and also in diabetes. As an injection, it is used in leucorrhœa.

Tamarindus—Tamarind—Officinal plant: *Tamarindus indica,* Linn.; *Monadelphia Triandria;* common Tamarind Tree. Illustration, plate 166, *Woodv. Med. Bot.* Officinal part: The preserved pulp of the fruit; imported from the West Indies. Officinal preparation: Enters into *Confectio Sennæ.*

Botany.—A tree thirty to forty feet high, with crooked and spreading branches, and light elegant foliage. *Leaves,* abruptly pinnate; leaflets, ten to fifteen pairs, small, narrow, oblong, obtuse, smooth. *Flowers,* yellow, variegated with red, in lateral and terminal racemes. *Legume,* stalked, pendulous, somewhat curved. *Seeds,* three to twelve, flattened, bluntly four-angled, brown-coloured, smooth, hard. *Habitat,* India and West Indies.

CHARACTERS.—*A brown, sweetish sub-acid pulp preserved in sugar, containing strong fibres, and brown shining seeds, each enclosed in a membraneous coat.*

Purity Test.—*A piece of bright iron, left in contact with the pulp for an hour, does not exhibit any deposit of copper.*

The officinal tamarind is prepared in the West Indies by first removing the hard shell or epicarp from the ripe fruit, and then placing the pulp in a cask or jar with alternate layers of sugar, and lastly, pouring boiling water over them ; or by packing the pulp in casks and pouring boiling syrup over it. The officinal pulp, which has the above characters, contains citric, tartaric, and malic acids, acid tartrate of potash, sugar, gum, pectin, parenchyma, and water. The above test is directed against copper.

Tamarind pulp acts as a refrigerant and laxative, and is more or less nutritious. It is given occasionally in febrile attacks. Tamarind whey, or an infusion of tamarinds, may be given as a refrigerant drink. But the pulp is seldom used alone, and is chiefly employed as an ingredient in confection of senna.

Copaiba—Copaiva.—Officinal plants : *Copaifera multijuga*, Hayne, *Darstellung* ; and other species of copaifera. Officinal parts :—1. The oleo-resin, obtained from the trunk by incision ; chiefly from the province of Para in Brazil. 2. Oleum Copaibæ, oil of copaiva ; the oil distilled from copaiva.

Botany.—The copaifera *(Decandria Monogynia)*, of which Hayne describes fourteen species, all inhabiting the Brazils, are trees or shrubs of Central America. *Leaves*, alternate, abruptly pinnate ; leaflets, alternate or opposite, somewhat unequal, coriaceous, ovate. *Flowers*, in compound axillary and terminal spikes. *Fruit*, leguminous, obliquely elliptical, stalked, compressed, coriaceous. *C. multijuga. Leaves*, equally pinnated ; leaflets, six to ten pairs, ovate-lanceolate, acuminate, unequal sided, with pellucid dots.

Characters of the Oleo-Resin.—*About the consistence of olive oil, light yellow, transparent, with a peculiar odour, and an acrid aromatic taste.*

Purity Tests.—*Perfectly soluble in an equal volume of benzol.*[1] *Does not become gelatinous after having been heated to 270°.*[2] *Is not fluorescent.*[3]

Characters of the Oil.—*Colourless or pale yellow, with the odour and taste of copaiva.*

[1 2 3] Does not contain wood oil.

Copaiva is sometimes spoken of as a balsam ; this is erroneous, as it contains neither benzoic nor cinnamic acid. Most of the copaiva of commerce is imported from Para and Maranham, in Brazil, and is believed to be yielded by *Copaifera multijuga.* It is also obtained in smaller quantities from British Guyana, from the West Indies, and from Rio Janeiro ; and a good deal is also brought to this country after passing through New York. Copaiva is obtained by making incisions into the stems of the trees during the very hot summer months, and the oleo-resin is said to flow from these wounds with such force as, in some cases, to cause a loud noise. So rapid is its exudation that a good tree, it is said, when tapped at the right time, will yield as much as twelve

pounds in three hours. The older trees are sometimes tapped successfully two or three times a-year. The oleo-resin is a clear, transparent liquid, having the consistency of olive oil, a pale straw colour, a peculiar resino-balsamic odour, and a bitter, acrid, nauseous taste. Its specific gravity varies, but is usually less than that of water. When kept for a length of time the volatile oil escapes, and the liquid becomes darker, thicker, and less odorous. It is soluble in alcohol, in ether, and in the fixed and volatile oils, but is insoluble in water. In all its physical properties copaiva is subject to wide modifications, and also in the proportionate quantities of oil and resin, differences which depend chiefly upon the species by which the oleo-resin is produced.

Copaiva consists chiefly of a volatile oil and a resin. *Oleum Copaibæ*, the volatile oil of copaiva, is prepared by distilling the oleo-resin with water ; it should be nearly, if not quite colourless, and possess the taste and odour of copaiva. It is isomeric with oil of turpentine. It is soluble in ether, in sulphuret of carbon, and in alcohol. Its density is 0·878. *Resin of Copaiba* is the residuum after the volatile oil has been abstracted by distillation from the oleo-resin, and occurs as a brownish resinous mass. It is sold, when the water has been driven off by a gentle heat, as *Resin of Copaiva.* It consists of two resins, called respectively *Copaivic acid* and the *Viscid resin of Copaiva :* these are easily separable by rectified spirit, which dissolves the copaivic acid, but leaves the viscid resin. *Copaivic acid* is isomeric with pinic acid, and constitutes about fifty per cent. of the oleo-resin. It is amber-coloured, crystallisable, and brittle ; soluble in alcohol, rectified spirit, ether, and in volatile and fixed oils. Its alcoholic solution reddens litmus, and it forms copaivates with bases.

The best test of the purity of copaiva is the quantity of volatile oil that can be obtained from it by distillation ; the finest kinds yield as much as sixty per cent., but it seldom yields more than between forty and fifty per cent., and some of it even less than that. Castor oil is occasionally met with as an impurity in copaiva ; its presence may be thus detected :—Pure copaiva will take up one-fourth of its weight of carbonate of magnesia by the aid of heat, and still remain clear, a soluble copaivate of magnesia being formed with the copaivic acid ; but if castor oil be present, a proportionate quantity of the magnesia will remain visible ; its presence may also be suspected if the copaiva remains turbid after it has been shaken with solution of ammonia of the density ·965, after which pure copaiva would immediately become clear and transparent. Again, by letting a drop of the copaiva fall upon clean, unsized paper, and expelling the volatile oil by heat, the presence of castor oil, or any other fixed oil, would be detected by forming a greasy areola around the homogeneous translucent spot left by the oleo-resin. Oil of turpentine, and other volatile oils, are detected by their odour when a little of the copaiva is dropped upon a heated spatula. Wood oil, distilled from the *Gurjun balsam*, produced by *Dipterocarpus turbinatus* and other species, as imported from Moulmein, in Burmah, is sometimes sold for copaiva, and is very like the darker varieties of it. Perhaps the substitution is not of very great importance, since the wood oil is probably as efficacious as the copaiva in the same class of cases. Wood oil is less soluble in benzol; produces with reflected light a greenish fluorescence, and besides, when heated in a corked vial to 270°,

becomes slightly turbid, and so gelatinous that when the bottle containing it is inverted, it does not run out, and when cooled remains almost solid; as copaiba is neither fluorescent nor so affected by heat, the presence of wood oil is readily detected by the pharmacopœal tests.

Dose.—Of the oleo-resin, ten minims to one fluid drachm; of the oil of copaiva, ten, twenty, or thirty minims. The resin of copaiva may be given in doses of ten to thirty grains; but it is rarely used now, though formerly highly esteemed. It is the least active part of the drug.

Copaiva may be given dropped upon sugar; made into pills with calcined magnesia or hydrate of lime; made into emulsion with mucilage, or with alkalies, or with yolk of egg; floated upon water flavoured with tincture of orange peel; in gelatine capsules; or in other forms; the object being to disguise its taste as much as possible. It may be combined with other drugs to prevent the griping and purging which it sometimes occasions.

Copaiva acts as a general and topical stimulant, occupying a place between the balsams and the turpentines. In medicinal doses it creates a feeling of warmth in the stomach, and is generally followed by unpleasant eructations, nausea, and sometimes by vomiting; it may also cause severe griping and purging. In over-doses it is apt to cause severe gastric irritation, vomiting, griping and purging, headache, hot skin, thirst, and sometimes ischuria and hæmaturia. It imparts its odour to the breath and to the urine. An eruption upon the skin, varying somewhat in character, is apt to follow the internal use of copaiva; and the urine, after copaiva has been taken for some days, when heated, assumes a milky appearance resembling the coagulation of albumen; it is not really albumen, however, and does not subside on standing, as albumen would do. Copaiva acts as a stimulant to the mucous membrane generally, but especially to the genito-urinary tract, and is chiefly used as a remedy for gonorrhœa. Some practitioners employ it in the early and inflammatory stage of this disease, others prefer to wait until the acute symptoms have been combated by antiphlogistic means. It is sometimes applied topically by injection; but this plan of treatment alone does not seem to be efficacious, and probably, although it is by topical action that it effects a cure, it is essential for it to arrive at the part by a passage through the system. It is not so useful in the treatment of gonorrhœa in the female as in the male, because in the former the inflammatory action spreads to parts not acted upon by the urine; but Dr Hardy has employed it successfully by first giving it internally, and then injecting the urine into the vagina. In other inflammatory affections of the same tract of

mucous membrane, copaiva is sometimes used with advantage, as in catarrhus vesicæ, but it must be stopped at once if it gives rise to increased irritation of the bladder. It may also be given in leucorrhœa; but it is to be remembered that it imparts a certain odour which is not generally considered creditable. It is also given in chronic affections of the pulmonary mucous membrane of an exhausting character, attended by profuse expectoration; but it is only in old-standing cases without inflammatory symptoms, in persons of debilitated and torpid constitution, that the stimulating effects of copaiva can be tolerated. The oil of copaiva being the active constituent of the oleo-resin, its action is similar to that of the copaiva itself.

Sub-Order 3. *Mimoseæ*—Gum Arabic Section. The plants of this section are characterised chiefly by gummy and astringent properties; they are chiefly confined to tropical regions; a good many are met with in the south temperate, but scarcely any in the north temperate zone.

Acaciæ Gummi—Gum Acacia.—Officinal plants: One or more undetermined species of *Acacia*, Linn.; *Polygamia Monœcia.* Officinal part: A gummy exudation from the stem; collected chiefly in Cordofan, in Eastern Africa, and imported from Alexandria. Officinal preparation: *Mucilago Acaciæ.* Enters into the composition of *Mistura Cretæ, Mistura Guaiaci, Pulvis Amygdalæ Compositus, Pulvis Tragacanthæ Compositus* and of all the *Trochisci.*

It has not been precisely determined which of the species of the genus *Acacia* yields the gum arabic of commerce; in fact, it is probably produced by many of the species, such as *Acacia vera, A. nilotica, A. arabica, A. Karoo, A gummifera, A. Seyal, A. tortollis, A. Ehrenbergii, A. Verek,* &c.

Botany.—The Acacias are shrubs or trees, some having stipular thorns or scattered prickles. The flowers are polygamous, and either yellow, white, or, occasionally, red. *Leaves,* pinnated; leaflets, eight to twenty pairs, linear. *Legumes,* continuous, dry, bivalved.

Gum arabic is chiefly the produce of Africa and Asia, and is imported from different parts of the Mediterranean, from India, and from the Cape. It flows spontaneously from the trunk and branches of the acacias, but is sometimes aided by incisions. It is at first in a liquid state, but soon hardens on exposure to the atmosphere. It makes its appearance at different periods of the year in different localities; in Bombay it exudes during the hot months of July and August, and the more sickly the appearance of the tree, and the more intolerable the heat of the weather, the greater is said to be the yield of gum. In Senegal the gum exudes during the rainy season, and is collected for the first time in December, and again in March, when the flow is facilitated by incisions. Several varieties of acacia gum are met with in commerce, known by the names of Gum arabic, Gum Senegal, Barbary gum, East India gum, Cape gum, &c.

CHARACTERS.—*In spheroidal tears usually from half-an-inch to an inch in length, nearly colourless, and opaque from numerous minute cracks, or in fragments with shining surfaces; brittle; bland and mucilaginous in taste; insoluble in alcohol, but soluble in water.*

PURITY TESTS.—*The aqueous solution forms with subacetate of lead an opaque white jelly. If an aqueous solution of iodine be added to the powder, or to a solution formed with boiling water and cooled, there is no appearance of a violet or blue colour.*

Inferior varieties of gum are often substituted for the better class, as by mixing the inferior kinds produced in Senegal or Bombay with the finer qualities, the characters of which are given in the Pharmacopœia, as above. The purest kind is obtained by selection, the transparent and whitish pieces being picked out and sold as *Gummi electum*, or picked gum. Flour or starch, when mixed with the powder of gum, may be recognised by the blue colour given with the solution of iodine. Gum arabic consists chiefly of the soluble gum *Arabin*, but some of the inferior kinds also contain the insoluble gum *Bassorin*. Gum is soluble in water, but insoluble in alcohol, which precipitates it from its watery solution. Perchloride of iron forms a brown jelly with it. Gum has a slightly acid reaction, probably due to the acid nature of arabin.

MUCILAGO ACACIÆ—MUCILAGE OF GUM ACACIA.—*Take of gum acacia, in small pieces,* 4 *ounces; distilled water,* 6 *fluid ounces. Put the gum and water into a covered earthen jar, and stir them frequently until the gum is dissolved. If necessary, strain the solution through muslin.*

Gum arabic acts topically as a demulcent and emollient; it does not produce any apparent constitutional effects, but is supposed to diminish irritation of the urinary passages. It has been recommended, rather as an article of diet than as a medicine, in diabetes, as a substitute for amylaceous food, as it is not converted into sugar. It is given to allay cough and irritation of the throat and air passages; to allay irritation of the genito-urinary mucous membrane, and to protect the stomach in irritant poisoning. Topically, a thick solution has been recommended as an application to burns and scalds, to chapped nipples, &c.; and powdered gum has been successfully employed, blown into the nostril, to arrest epistaxis. But it is chiefly employed for pharmaceutical purposes, to suspend heavy oleaginous or resinous insoluble substances in mixtures or emulsions; to form lozenges, certain pill masses, &c.

Catechu Nigrum—Black Catechu.—From *Acacia Catechu*, Willd. *Enum; Polygamia Monœcia;* the Catechu Acacia. Illustration, plate 66, *Woodv. Med. Bot.* (*Mimosa Catechu*). An extract of the heart-wood; imported from Pegu. Catechu Nigrum was formerly officinal, but has been omitted in the present edition of the "British Pharmacopœia." The *Acacia Catechu* is a tree from fifteen to twenty or more feet in

height. *Bark*, brown and scabrous. *Wood*, hard and heavy ; the heart-wood is of a dark-red or brownish colour, whilst the sap-wood is white. *Branches*, generally with stipulary thorns. *Leaves*, bipinnate ; leaflets, thirty to fifty pairs, linear, oblong. *Inflorescence*, a spike, with numerous white flowers. *Fruit*, legumes with five to six seeds. The Catechu is an extract from the heart-wood, and is made up in masses consisting of layers enveloped in rough leaves. These masses are of a blackish-brown colour, shining, heavy, bitter, and very astringent. It is called by the natives Kut or Kutch. During the season for preparing it, the manufacturers live in tents in the jungle. Selecting suitable trees, they cut their duramen or heart-wood into small chips, and place them with a little water in small earthen pots, arranged in a double row upon a fire-place built of mud. When a certain quantity of the water has been dissipated by boiling, the clear decoction is removed and strained into another series of pots, when it is evaporated to a proper consistence, and then poured into clay moulds. This variety of Catechu is in no respect therapeutically different from the pale or officinal variety. It is a simple astringent, and may be administered in doses of ten to sixty grains in diarrhœa.

ROSACEÆ—The Rose Order.—Trees, shrubs, or herbs, inhabiting various parts of the world, but chiefly the temperate climates. This order is subdivided into four sub-orders, namely, *Chrysobalaneæ*, *Amygdaleæ* or *Drupiferæ*, *Roseæ*, and *Pomeæ*. The plants of the order vary in their medicinal properties ; in some cases the barks and roots are astringent ; the seeds, flowers, leaves, and young shoots of many of the plants of the Sub-orders *Amygdaleæ* and *Pomeæ* furnish hydrocyanic or prussic acid, and are occasionally poisonous. Many of the plants supply succulent edible fruits. Officinal plants : 1. Of the Sub-order *Chrysobalaneæ*, none. 2. Of the Sub-order *Amygdaleæ*, *Amygdalus communis*, *Prunus domestica*, *Prunus laurocerasus*. 3. Of the Sub-order *Roseæ*, *Rosa canina*, *Rosa gallica*, *Rosa centifolia*, *Brayera anthelmintica*. 4. Of the Sub-order *Pomeæ*, none.

SUB-ORDER AMYGDALEÆ OR DRUPIFERÆ.—Trees or shrubs, inhabiting the mountainous parts of the north temperate zone, and extensively cultivated. Their fruits are frequently edible, oil is obtained from the kernels, many of the plants furnish hydrocyanic acid, and some of them exude gum.

Amygdala Dulcis—The Sweet Almond.—Officinal plant : *Amygdalus communis*, var. *dulcis*, DC. ; *Icosandria Monogynia ;* the Sweet Almond Tree. Illustration, plate 83, *Woodv. Med. Bot.* Officinal parts :—1. The seed ; from trees cultivated about Malaga. 2. *Oleum Amygdalæ*, Almond Oil ; the oil expressed from bitter and sweet almonds. Officinal preparations : *Mistura Amygdalæ*, *Pulvis Amygdalæ Compositus*.

Botany.—A small tree. *Leaves*, lanceolate, glandulary serrate ; petioles, glandular. *Flowers*, nearly sessile, solitary, appearing before the leaves. *Fruit*, a dry drupe, ovoid, compressed, bursting irregularly when ripe ; within this is the hard, brittle shell, endocarp or putamen, which contains one seed, the almond of commerce. *Habitat*, Barbary, Persia, Syria, and largely cultivated in many parts of the south of

Europe. The sweet and bitter almond-trees are generally considered to be merely varieties of the same species.

Characters.—*Above an inch in length, lanceolate, acute, with a clear cinnamon brown seed-coat, and a bland, sweetish, nutty-flavoured kernel.*

Purity Tests. — *Does not evolve the odour of bitter almonds when bruised with water.*

Almonds are of two kinds, sweet and bitter. The sweet almond is inodorous, of a sweetish, bland, and pleasant taste. The commercial varieties of this kind are numerous. The Jordan almond is the most esteemed variety ; it is imported from Malaga, and is of two kinds, one plumper and shorter than the other, but both of good quality and sweet. Other varieties are known as Valentia, Barbary, Italian, Portugal, or Canary almonds. Both sweet and bitter almonds contain a bland, fixed oil, emulsin, liquid sugar, gum, &c.

MISTURA AMYGDALÆ—Almond Mixture.—*Take of compound powder of almonds, 2½ ounces ; distilled water, 1 pint. Rub the powder with a little of the water into a thin paste, then add the remainder of the water, and strain through muslin.*

PULVIS AMYGDALÆ COMPOSITUS—Compound Powder of Almonds.—*Synonyms :* Confectio Amygdalæ, *Lond. ;* Conserva Amygdalarum, *Ed.—Take of sweet almonds, 8 ounces ; refined sugar, in powder, 4 ounces ; gum acacia, in powder, 1 ounce. Steep the almonds in warm water until their skins can be easily removed ; and when blanched, dry them thoroughly with a soft cloth, and rub them lightly in a mortar to a smooth consistence. Mix the gum and the sugar, and, adding them to the pulp, gradually rub the whole to a coarse powder. Keep it in a lightly-covered jar.*

Dose.—Of the mixture, one to two fluid ounces ; acids and tinctures coagulate the emulsion and form a curdy precipitate, which is also formed spontaneously when the mixture is long kept. The compound powder is used only in the preparation of the mixture. Oil of almonds is sometimes given as a laxative to children, in doses of one or two fluid drachms.

Sweet almonds, when fresh, are nutritive, demulcent, and emollient ; in consequence of the oil which they contain they are somewhat indigestible, especially when rancid. The skins or husks of sweet almonds have been known to cause considerable irritation of the alimentary canal, attended with œdema of the face and urticaria ; hence they are blanched when used as dessert. Bitter almonds are poisonous, producing effects similar to those of poisoning by hydrocyanic acid. Almond mixture is used, either alone or as an elegant vehicle for other remedies of the same class, as a demulcent in irritable and inflammatory conditions of the mucous membranes. Almond oil is employed in the preparation of spermaceti and simple ointments ; and is used externally as an emollient.

Amygdala Amara—Bitter Almond.—Officinal plant: *Amygdalus communis*, var. *Amara*, DC. Officinal part: the seeds; brought chiefly from Mogadore.

CHARACTERS OF THE SEED.—*Resembles the sweet almond in appearance, but is rather broader and shorter; has a bitter taste, and when rubbed with a little water emits a characteristic odour.*

It yields by expression,

OLEUM AMYGDALÆ—ALMOND OIL.—This oil is obtainable also from the sweet almond, but is chiefly prepared from the bitter variety, because the former is much more expensive. Its specific gravity varies from 0·911 to 0·920. It consists of Margarine 24, and Elaine 76, in 100 parts. Freshly expressed, it is turbid, but becomes clear by rest and filtration. It is apt to become rancid. It is employed in the preparation of several ointments.

CHARACTERS.—*Pale yellow, nearly inodorous or having a nutty odour, with a bland oleaginous taste.*

When water is added to the residual cake left after expression of the fixed oil, there is formed

OLEUM AMYGDALÆ AMARÆ—*Oil of Bitter Almonds, Volatile or Essential Oil of Almonds.*

This oil does not exist in the bitter almond, but is derived from it by distilling with water the cake which remains after the fixed oil has been expressed. Bitter almonds are imported chiefly from Mogadore, and contain the same ingredients as sweet almonds, but moreover a peculiar inodorous bitter principle, which is soluble in water and in boiling alcohol, and is termed *Amygdalin*. The amygdalin and the emulsin of the almond are contained in separate cells, and it is not until these are crushed, as in the expression of the fixed oil, that they are brought into contact; but still the volatile oil is not produced until water is added, as in the distillation, when the emulsin, acting the part of a ferment, and hence also called *Synaptase*, converts the amygdalin into the complex substance known as oil of bitter almonds. Emulsin, also called the vegetable albumen of almonds, is coagulated by boiling water, and therefore if a heat equal to 212° be employed in the expression of the fixed oil, which is usually cold drawn, it can no longer act as a ferment, and would not then produce the volatile oil. It is to this emulsin also that suspension of the fixed oil in almond emulsin is due. Hydrocyanic acid, grape sugar, formic acid, and water, are also derived from the amygdalin at the same time as the essential oil.

Volatile oil of bitter almonds is highly poisonous. Its odour is commonly said to be like that of hydrocyanic acid, but it has a peculiar odour, in addition to that of prussic acid. It is usually of a golden yellow colour, has a bitter, acrid taste, burns with a white flame, and is soluble in alcohol and in ether. Sulphuric acid gives with it a crimson-red thick liquid, which becomes a yellow emulsion on the addition of water. As met with in commerce, it consists chiefly of hydruret of benzule, hydrocyanic acid, a little benzoic acid, benzoine, and benzimide. This essential oil acts, in accordance with the hydrocyanic acid which it contains, as a most energetic poison. It is rarely used as a medicine in this country,

in consequence of the uncertainty of its strength. When given internally, the dose should not be greater than the quarter of a drop, cautiously increasing to a drop or a drop and a-half, suspended in emulsion. Perfumers use it for scenting soap, &c., and confectioners for making almond flavouring. Many cases of poison are recorded from eating confectionery flavoured with a too strong spirituous solution of the oil : macaroons, ratafia cakes, the almond icing of bride's cake, and noyau, all contain almond flavouring.

It is convenient to place here the officinal diluted hydrocyanic acid, although it is not derived from a vegetable source.

Acidum Hydrocyanicum Dilutum—Diluted Hydrocyanic Acid—Prussic Acid—Zootic Acid—Cyanide of Hydrogen—Acide Hydrocyanique—Blausaure.—Hydrocyanic Acid, HC_2N, or $6HCN$, dissolved in water, and constituting two per cent. of the solution.

PREPARATION.—*Take of yellow prussiate of potash,* $2\frac{1}{4}$ *ounces; sulphuric acid,* 1 *fluid ounce; distilled water,* 30 *fluid ounces, or a sufficiency. Dissolve the prussiate of potash in ten ounces of the water, then add the sulphuric acid, previously diluted with four ounces of the water and cooled. Put the solution into a flask or other suitable apparatus of glass or earthenware, to which are attached a condenser and a receiver arranged for distillation ; and having put eight ounces of distilled water into the receiver, and provided efficient means for keeping the condenser and receiver cold, apply heat to the flask, until by slow distillation the liquid in the receiver is increased to seventeen fluid ounces. Add to this three ounces of distilled water, or as much as may be sufficient to bring the acid to the required strength, so that one hundred grains (or* 110 *minims) of it, precipitated with a solution of nitrate of silver, shall yield ten grains of dry cyanide of silver.*

Rationale.—The ferrocyanide of potassium is decomposed by the sulphuric acid, the resulting compounds being hydrocyanic acid, which is distilled over, and bisulphate of potash and Everitt's yellow salt, which remain behind. Thus $2K_4Fe(CN)_6 + 6H_2SO_4 = 6KHSO_4 + 2KFe(CN)_3 + HCN$.

CHARACTERS.—*A colourless liquid with a peculiar odour. Specific gravity,* 0·997.[1] *It only slightly and transiently reddens litmus paper.*[2] *A fluid drachm of it evaporated in a platinum dish leaves no fixed residue.*[3]

[1] The specific gravity is an indication of the strength of this acid ; but it is too delicate a test for ordinary application, the smallest departure from the proper density representing a great difference in the strength of the acid. [2] The presence of hydrochloric acid, or of nitric acid, would be suspected if the reddening were permanent. [3] The absence of fixed impurities is established by no residue being left on heating.

Officinal diluted hydrocyanic acid is a limpid, transparent, colourless liquid, having a peculiarly penetrating odour—somewhat resembling, yet readily distinguishable from, that of the volatile oil of bitter almonds—and a warm and bitter taste. The officinal acid contains two per cent. of anhydrous acid. Scheele's acid contains from four to five per cent. of the anhydrous acid ; the acid of the London and Dublin Pharmacopœias contained two per cent. ; that of the Edinburgh Pharmacopœia 3·3 per cent.

TESTS.—*Treated with a minute quantity of a mixed solution of sulphate and persulphate of iron, afterwards with potash, and finally acidulated with hydrochloric acid, it forms Prussian blue.*[1] *It gives no precipitate with chloride of barium,*[2] *but with nitrate of silver it gives a white precipitate, entirely soluble in boiling concentrated nitric acid.*[3] 270 *grains of it rendered alkaline by the addition of solution of soda, require* 1000 *grain-measures of the volumetric solution of nitrate of silver to be added before a permanent precipitate begins to form, which corresponds to two per cent. of the real acid.*[4]

[1] Characteristic of prussic acid, or its compounds. [2] Absence of sulphuric acid. [3] Proves the precipitate to be a cyanide, and not a chloride; and, consequently, proves the absence of hydrochloric acid as an adulteration.[4] The explanation of this test is that the soda abstracts the nitric acid from the nitrate of silver to form nitrate of soda, leaving oxide of silver, which would at once remain as a permanent precipitate, thus—($2\,AgNO_3 + 2\,NaHO = Ag_2O + 2\,NaNO_3 + H_2O$), were it not for the cyanogen of the hydrocyanic acid with which the silver forms a double salt, the cyanide of sodium and silver, which is soluble, thus—($HCN + NaHO = NaCN + H_2O$, and $AgNO_3 + 2NaCN = NaNO_3 + AgNa(CN)_2$); therefore it is not until the hydrocyanic acid is entirely exhausted that the precipitate of oxide of silver remains permanently.

VAPOR ACIDI HYDROCYANICI—INHALATION OF HYDROCYANIC ACID.—*Take of diluted hydrocyanic acid,* 10 *to* 15 *minims; water (cold),* 1 *fluid drachm. Mix in a suitable apparatus, and let the vapour that arises be inhaled.*

This is a convenient form for administering hydrocyanic acid as a sedative in irritable conditions of the chest.

Dose.—Of the officinal diluted acid, one or two mimims, cautiously increased up to six or eight mimims; the dose may be repeated at intervals of two or three hours as the effects quickly pass off, and it is advisable to give it either in plain water or other simple vehicle. When prescribed in the form of mixture, directions should be given to shake the bottle before each dose is taken, because the acid is apt to accumulate, in the form of vapour, in the empty part of the bottle, and would escape if this precaution were not enjoined. As a lotion, one or two fluid drachms to eight ounces of distilled water, taking care to avoid broken surfaces in its application.

Antidotes.—It is but seldom that antidotes can be available against a poison so subtle and swift as hydrocyanic acid, when taken in large quantity; nevertheless, all the means at our disposal are to be carefully and perseveringly employed. The indications of treatment are to neutralise the poison, and to sustain the patient's life until its somewhat transient effects have disappeared. Should there be a tendency to vomit, this may be encouraged; but if not, it is better not to attempt to excite it, as it would only be a waste of time that might be more profitably employed, and if unsuccessful, would do harm by promoting absorption. Rather than trust to antidotes, attempts should be made at once to rouse the patient by dashing cold water on his head from a height, or by pouring it over the shoulders and along the spine. Ammonia, either in vapour to the nostrils, or in solution by the mouth, if the patient can swallow; friction and other means should also be employed to rouse the

patient. Artificial respiration, when required, should be employed perseveringly, and perhaps this and the cold douche are the most reliable of the means available for restoring the patient. Chlorine gas, or a solution of the hypochlorite of soda or of lime, has been recommended.

Messrs T. and H. Smith, of this city, many years ago (1844), published in the *Lancet* a method for counteracting the poisonous action of prussic acid, a plan which then received the favourable recognition of eminent toxicologists. By a series of careful experiments they have been enabled to simplify their process to such an extent as to render it, if not a more certain, at least a more available remedy. They propose to attach to bottles containing *Liquor Ferri Perchloridi* a label containing the following instructions :—

"*Prussic Acid Antidote.*— Take of liquor of perchloride of iron, 37 minims; protosulphate of iron in crystals, as pure as possible, 25 grains ; as much water as will make a solution of a protosesquisalt of iron, measuring about half-an-ounce. Dissolve, on the other hand, 77 grains crystallised carbonate of soda in about half-an-ounce of water. These quantities destroy the poisonous action of between 100 and 200 mimims of medicinal prussic acid, officinal strength, on giving first the one liquid and then the other."

Note.—"To be suitable for the antidotes, the liquor ferri perchloridi must answer to the following tests :—One fluid drachm must contain 15·62 grains peroxide of iron ; ammonia must give a pure reddish-brown precipitate, without any shade of black ; it must not smell strongly acid, nor, after slight dilution, give a brisk effervescence with a piece of zinc."

More recently, they have suggested the employment of calcined magnesia instead of crystallised carbonate of soda. The question is one of so much importance that I think it desirable to exceed the limits proposed for this article by introducing their reasons for this change at full length, as quoted from a paper which they have been good enough to send to me, and which may be consulted in the *Pharmaceutical Journal* of November 1865 :

"In addition to and completion of our late remarks, in this Journal, on sol. ferri perchloridi as an antidotal agent in poisoning by either prussic acid, antimony, or arsenic, it occurred to us, while our manuscript was in the compositors' hands, that the question may be asked, What effect would the not unlikely occurrence of free acid in the stomach have on the action of the prussic acid antidote when its use may be indicated? If the amount of acid could be known, the answer would be easy, viz., the corresponding quantity of an alkali given in advance would prevent any interference with the desired action ; but a quantity of alkali so great would be required to meet the most extreme case, that the remedy might itself have an injurious action, or might form a soluble yellow prussiate which, although not poisonous, would be a less desirable product than the insoluble and inert Prussian blue. It therefore suggested itself to our minds that caustic magnesia might be a more desirable agent in such a case. A single trial showed that every difficulty is removed by the use of that substance, and that it does not interfere with the action of the antidote.

"Ninety grains of calcined magnesia were made into a smooth cream with a little water ; two drachms of muriatic acid were then added, and the acid was instantly neutralised, yet leaving a large excess of magnesia. 100 minims of medicinal prussic acid were now added, and on now pre-

paring to add the alkaline solution to form a cyanide, before the addition of the iron solution, it occurred to us that the excess of magnesia itself might form the cyanide necessary to the formation of the Prussian blue. Resolving, therefore, to put the idea to the test, we at once added the iron solution, and the moment contact between the two liquids occurred, the blue colour showed that the formation of Prussian blue had, to a certain extent, been the result. After the addition of a solution containing $11\frac{1}{2}$ minims of solution of perchloride of iron, and $8\frac{1}{4}$ grains of green vitriol, muriatic acid was added till the excess of magnesia and the excess of proto-peroxide of iron had been dissolved. Prussian blue was left in abundance. On now at once filtering, and adding to the filtered liquid a few drops of a solution of persalt of iron, no Prussian blue was formed, showing the absence of any ferro-prussiate. On now adding aqua potassæ to neutralise the excess of acid and throw down the iron in solution, no tinge of blue was produced, not even on adding an excess of dilute muriatic acid. The precipitate entirely dissolved to a clear solution. The complete absence of prussic acid was thus proved. All of it had been completely removed.

"We prepared as above another quantity of magnesia emulsion mixed with prussic acid, and, after adding the iron solution, the liquid, having been filtered from the mixture, was without delay distilled, and on testing the distillate, it neither answered to the Prussian blue nor to the silver test; it contained no prussic acid.

"We believe ourselves justified in now giving, as the antidote for prussic acid, magnesia and a proto-persalt of iron, thus :—Make into a smooth cream, with water, from 1 to 2 drachms of calcined magnesia. Give the emulsion to the patient, then give, in water, a solution of 16 minims of perchloride of iron, and $12\frac{1}{2}$ grains of green vitriol. These numbers, being in excess of the theoretical quantity, were those used in our experiments. Should it be supposed that so much as 400 minims medicinal prussic acid had been taken, of course four times the quantity of the iron compound necessary for 100 minims should be given, but without altering the quantity of magnesia.

"Although calcined magnesia, *alone*, slowly dissolves in prussic acid, yet in the presence, simultaneously, of a large excess of magnesia and the solution of a proto-persalt of iron, the reciprocal action resulting in the formation of a Prussian blue seems to be almost instantaneous."

Hydrocyancic acid, in over-doses, acts as a most powerful and rapid poison. Even smelling a bottle containing a strong sample of the acid might produce dangerous effects, and the vapour of the anhydrous acid would be immediately fatal if respired. So quick is it in its action as a poison, that it is very difficult to record accurately the succession of symptoms which follow an over-dose. The following is a collection of symptoms which have been observed in various cases, rather than a necessary result to be observed in any particular case. The poisoning usually begins instantaneously, and when a large dose is taken, is seldom protracted beyond a minute or two. There may be heat and constriction of the mouth and fauces,

vertigo, tinnitus aurium, faintness, profound insensibility, fixidity of the eyeballs, pupils dilated and insensible to the action of light; more or less of rigidity of the voluntary muscles, or the limbs may be flaccid; pulse weak and fluttering, or imperceptible; skin pallid, cold, and bathed in perspiration; frothing at the mouth; breathing heavy and laboured, with intervals of perfect repose, sometimes stertorous; convulsions usually occur in the inferior animals, but seldom are seen in the human subject, except a dose sufficiently large to kill, and yet not to produce instant death, has been taken; there is occasionally relaxation of the sphincters and involuntary evacuation of the bowels. It has been stated that other symptoms are sometimes preceded by a loud shriek, but this has not been established. In small but dangerous doses, the common symptoms are giddiness, faintness, nausea, confusion of intellect, muscular prostration, hurried respiration, and a quick pulse. An odour of hydrocyanic acid may be perceived in the breath and apartment. Although usually exceedingly rapid in its action, there are many cases on record in which persons who have committed suicide by prussic acid have had time to cork the bottle from which the poison had been taken, arrange themselves comfortably in bed, or walk a few paces, before the symptoms overcame them. Death generally takes place, when large doses are taken, within from two to ten minutes; and although a few cases are recorded in which death has taken place so long as an hour afterwards, recovery commonly takes place when the patient is kept alive during the first half hour. It is difficult to state what may be the least quantity that would cause death, as so much depends upon idiosyncracy and the condition of the person, in many respects, at the time; but it must be borne in mind that the incautious addition of an extra drop or two of the medicinal acid to a dose which has been gradually increased to a considerable quantity, has been known to cause very alarming symptoms.

Medicinally, hydrocyanic acid acts as a sedative, calmative, anodyne, and antispasmodic, and it is employed chiefly to diminish the force and frequency of the pulse, to calm nervous excitement, to allay irritability, to soothe pain, and to relieve spasm. When applied externally, it seems to exercise a topical anæsthetic action, causing numbness and insensibility, more or less, to pain, without affecting the nervous centres. It has been given in hypertrophy of the heart, in nervous palpitation, in angina pectoris, in pericarditis, &c.; to allay the cough of phthisis, and that of nervous and hysterical females; to relieve painful and spasmodic affections of the

stomach and bowels, in gastrodynia, enterodynia, pyrosis, visceral neuralgia, in chronic vomiting, colliquative diarrhœa and sweating; in pertussis and spasmodic asthma; in hæmoptysis; in various forms of neuralgia, in rheumatism, and in painful diseases, such as cancer; in chorea, epilepsy, tetanus, &c. Externally, it is used, sufficiently diluted, to allay the itching and irritation of certain skin diseases, care being taken to avoid broken surfaces.

Prunum—Prune.—Officinal plant: *Prunus domestica*, Linn.; *Icosandria Monogynia;* the Plum Tree. Illustration, plate 85, *Woodv. Med. Bot.* Officinal part: The dried drupe; from plants cultivated in southern Europe. Officinal preparation: Enters into *Confectio Sennæ.*

Botany.—A small tree with smooth branches. *Leaves*, elliptical. *Flowers*, white. *Drupes*, fleshy. *Habitat*, probably originally from Asia, but common in Europe.

CHARACTERS OF PRUNES.—*About an inch long, ovate, wrinkled, black, sweet, and somewhat austere.*

Prunes are used in pharmacy only in the preparation of confection of senna. They are nutrient, and somewhat laxative, and are used for a variety of domestic purposes.

Laurocerasi Folia—Cherry Laurel Leaves.—Officinal plant: *Prunus Laurocerasus*, Linn.; *Icosandria Monogynia;* the Common or Cherry-Laurel. Illustration, plate 117, *Steph. and Church. Med. Bot.* Officinal part: The fresh leaves; from plants cultivated in Britain. Officinal preparation: *Aqua Laurocerasi.*

Botany.—A small tree or evergreen shrub. *Leaves*, short-stalked, oblong, coriaceous, shining on the upper surface, with two to four glands beneath. *Flowers*, in axillary racemes, white. *Drupes*, about the size of a small cherry, round, black, without bloom. *Habitat*, Asia; common in gardens and shrubberies throughout Europe.

CHARACTERS OF THE LEAVES.—*Ovate-lanceolate or elliptical, distantly toothed, furnished with glands at the base, smooth, and shining, deep green, on strong short footstalks; emitting a ratafia odour when bruised.*

The leaves have a bitter, aromatic, and slightly astringent taste, and give the characteristic amygdalin odour when bruised, but this odour is lost when the leaves are dried. By distillation with water they yield a volatile oil identical with that of bitter almonds.

AQUA LAUROCERASI—LAUREL WATER.—*Take of fresh leaves of common laurel,* 1 *pound; water,* 2½ *pints. Chop the leaves, crush them in a mortar, and macerate them in the water for twenty-four hours; then distil one pint of liquid. Shake the product, filter through paper, and preserve it in a stoppered bottle.*

Dose.—Ten to thirty minims: it is a very unsafe remedy for children, in consequence of its variable strength, and should not be given to them, if at all, in doses larger than two to five minims. *Antidotes*, same as for hydrocyanic acid.

Laurel water acts in accordance with the hydrocyanic acid which it contains. It is of uncertain strength and is rarely used, the officinal diluted hydrocyanic acid being a much more controllable and trustworthy medicine. Poisonous effects have followed after eating confectionery flavoured with cherry-laurel.

SUB-ORDER ROSEÆ.—Shrubs or herbs inhabiting cold and temperate climates, chiefly characterised by astringent or febrifugal properties.

Rosæ Caninæ Fructus—Hips.—Officinal plant: *Rosa Canina*, Linn.; *Icosandria Polygynia*; The Dog Rose. Illustration, plate 139, *Woodv. Med. Bot.*, and other allied species. Officinal part: The ripe fruit of indigenous plants, deprived of the hairy seeds (achenes). Officinal preparation: *Confectio Rosæ Caninæ.*

Botany.—A variable species, with varieties having distinct names. *Shoots,* arched or erect, with uniform hooked prickles. *Leaves,* glandless, naked, or slightly hairy. *Flowers,* rose-red coloured. *Fruit,* scarlet or crimson, ovoid, succulent, with a sweetish acidulous pulp. *Habitat,* indigenous.

CHARACTERS OF HIPS.—*An inch or more in length, ovate, scarlet, smooth, shining; taste sweet, subacid, pleasant.*

This fruit consists of the persistent calyx, which, when gathered, contains numerous hard achenes; these are surrounded by fine hairs or setæ, which act, like the hairs of the pods of cowhage, as mechanical irritants, and therefore they are to be removed.

This confection is employed only as a pill-basis, or for forming other remedies into electuaries or linctuses.

CONFECTIO ROSÆ CANINÆ—CONFECTION OF HIPS.—*Take of hips, deprived of their seeds,* 1 *pound; refined sugar,* 2 *pounds. Beat the hips to a pulp in a stone mortar, and rub the pulp through a sieve; then add the sugar, and rub them well together.*

Used in the preparation of *Pilula Quiniæ.*

Rosæ Gallicæ Petala—Red-Rose Petals.—Officinal plant: *Rosa gallica*, Linn. Illustration, plate 141, *Woodv. Med. Bot.* Officinal part: The unexpanded petals, fresh and dried; from plants cultivated in Britain. Officinal preparations: *Confectio Rosæ Gallicæ, Infusum Rosæ Acidum, Syrupus Rosæ Gallicæ.*

Botany.—A small shrub. *Shoots,* armed with nearly equal uniform prickles and glandular bristles intermixed. *Leaflets,* stiff, elliptical, rugose. *Flowers,* several together, large, erect, with leafy bracts. *Habitat,* south of Europe; cultivated in gardens in this country.

CHARACTERS OF THE PETALS.—*Colour fine purplish-red, retained after drying; taste bitterish, feebly acid, and astringent; odour roseate, developed by drying.*

This plant is cultivated for medicinal purposes at Mitcham; the unexpanded petals are much more astringent than the full-blown flowers.

CONFECTIO ROSÆ GALLICÆ.—CONFECTION OF ROSES.—*Take of fresh red-rose petals,* 1 *pound; refined sugar,* 3 *pounds. Beat the petals to a pulp in a stone mortar, add the sugar, and rub them well together.*

INFUSUM ROSÆ ACIDUM—ACID INFUSION OF ROSES.—*Take of dried red-rose petals, broken up,* ¼ *ounce; diluted sulphuric acid,* 1 *fluid drachm; boiling distilled water,* 10 *fluid ounces. Add the acid to the water, infuse the petals in the mixture in a covered vessel for half-an-hour, and strain.*

SYRUPUS ROSÆ GALLICÆ—SYRUP OF ROSES.—*Take of dried red-rose petals,* 2 *ounces; refined sugar,* 30 *ounces; boiling distilled water,* 1 *pint. Infuse the petals in the water for two hours, squeeze through calico, heat the liquor to the boiling point, and filter. Dissolve the sugar in the liquor by means of heat. The product should weigh two pounds fourteen ounces, and should have the specific gravity* 1·335.

Dose.—The confection is chiefly used as a pill basis, but may be given as a mild astringent in doses of sixty grains or more; of the infusion, one to two fluid ounces; of the syrup, one to two fluid drachms.

The preparations of the red-rose petals are chiefly used to give colour and flavour, and to perform the part of vehicles to other medicines. They are somewhat astringent, and the infusion forms an agreeable refrigerant and astringent.

Rosæ Centifoliæ Petala—Cabbage Rose Petals.—Officinal plant: *Rosa Centifolia*, Linn.; The Hundred-Leaved or Cabbage Rose. Illustration, plate 140, *Woodv. Med. Bot.* Officinal part: The fresh petals fully expanded; from plants cultivated in Britain. Officinal preparation: *Aqua Rosæ.*

Botany.—A bushy shrub. *Shoots,* erect, rather thickly covered with nearly straight prickles, intermixed with glandular hairs. *Leaflets,* five to seven, oblong or ovate, glandular at the margin; hairy beneath. *Flowers,* several together, drooping. *Habitat,* Asia, cultivated at Mitcham for medicinal purposes, and in gardens commonly.

CHARACTERS OF THE PETALS.—*Taste sweetish, bitter, and faintly astringent; odour roseate; both readily imparted to water.*

The petals contain a volatile oil (Attar of Roses), which gives them a delightful fragrance.

AQUA ROSÆ—ROSE WATER.—*Take of fresh petals of the hundred-leaved rose (or an equivalent quantity of the petals preserved while fresh with common salt),* 10 *pounds; water,* 2 *gallons. Distil one gallon.*

Rose water is used chiefly on account of its fragrance, in the preparation of lotions and collyria. It is an ingredient of *Mistura Ferri Composita,* and of *Trochisci Bismuthi.*

Cusso — Kousso.—Officinal plant; *Brayera anthelmintica,* DC.; *Diœcia Polyandria;* the Kousso Tree. Illustration, plate 10, vol. ii. *Hooker's Journ. Bot., 3d ser.* Officinal part: The flowers; collected in Abyssinia. Officinal preparation: *Infusum Cusso.*

Botany.—A tree, twenty feet high. *Branches,* round, rusty. *Leaves,* crowded, alternate, interruptedly inpari-pinnate. *Leaflets,* oblong, or elliptical-lanceolate, acute. *Flowers,* diœcious, small, at first greenish, afterwards becoming purple. *Habitat,* Abyssinia.

CHARACTERS.—*Flowers small, reddish-brown, on hairy stalks, outer limb of calyx five-parted, the segments oblong or oblong-lanceolate reticulated.*

The flowers of commerce are met with in bunches, the male and female flowers being mixed together; they have a fragrant balsamic odour, and a somewhat acrid and disagreeable taste. They contain a volatile oil, a bitter acrid resin and tannin. A crystalline principle was obtained by Martin, called *Kwoseine;* and a yellow, bitter uncrystallisable substance was obtained by Pavesi, and also by Vée termed *Koussine.*

INFUSUM CUSSO—INFUSION OF KOUSSO.—*Take of Kousso, in coarse powder,* ½ *ounce: boiling distilled water,* 8 *fluid ounces. Infuse in a covered vessel for fifteen minutes, without straining.*

Dose.—For an adult, one-fourth to one-half ounce of the flowers; of the infusion, four to eight ounces; for a child, half that quantity. The infusion is administered in the following manner:—Let the last meal of the evening be slight, then on the following morning, fasting, let the patient take the infusion well stirred, swallowing both the powdered flowers and water; the dose is divided into two or three draughts, taken at short intervals, each of which is to be followed by a draught of cold water and lemon juice. The action of the medicine may in a little while be promoted by a drink of tea, taken without sugar or milk. In three or four hours, if the medicine has not operated, a dose of castor oil, or a saline purgative should be administered.

Kousso acts as an anthelmintic, and is effectual in both kinds of tape worm, namely *Tœnia solium* and *Bothriocephalus latus.* It operates probably by a toxic or poisonous effect upon the worm, and not by a mere mechanical or purgative influence; it is therefore regarded as a *vermicide.* It does not usually produce any marked physiological effects; but may be followed by nausea or vomiting, thirst, and a very slight action upon the bowels.

POTENTILLA TORMENTILLA—TORMENTIL.—*Icosandria Polygynia.* An indigenous plant growing on barren pastures, heaths, and bushy places; it has a large irregularly tuberous-shaped perennial root, a weak, slender, often procumbent, and much branched stem; dark-green and somewhat hirsute leaves, and bright-yellow flowers. The rhizome was formerly officinal; it is of irregular shape, and of great size, as compared with the entire plant; it is sometimes nearly cylindrical, but often knotty and tuberculated, dark-brown externally, flesh-red internally, has a strong astringent taste, but little odour. Tormentil acts as an astringent and tonic, and is used in chronic diarrhœa and dysentery, and in passive hemorrhages; as an injection in mucous discharges, and as an astringent wash to indolent sores. *Dose,* of the powdered root, thirty to sixty grains. *Decoctum Tormentillœ* (L.P.) contains two ounces of

bruised tormentil to a pint and a-half of water, boiled down to a pint. *Dose*, one or two fluid ounces; used also as a lotion and injection.

Geum urbanum. Common avens—has properties similar to those of tormentil, and has been used in similar cases. It is indigenous, growing in shady places, woods, and hedge-rows.

CYDONIUM—QUINCE.—Cydonia vulgaris. *Icosandria Pentagynia.* Sub-order, *Pomeæ.* The seeds of the common Quince were formerly officinal. This tree is small, usually crooked, and much branched, with ovate, obtuse leaves, and large, solitary, pale rose-coloured flowers, few in number. The fruit is a closed, globose or oblong pome, yellow and austere, but with an agreeable odour; it is five-celled, each cell containing many seeds, enveloped in a condensed mucilage. The seeds are of a reddish-brown colour, flat on one side, convex on the other, and ovate-acute. They are covered with a coat of fine cellular structure, in which is much mucilage; when immersed in water, the mucilage swells, distends, and bursts the cells. The fruit, when stewed or otherwise cooked, is eaten, but is not fit for food in the raw state; it is made into marmalade, or is used to flavour other fruits. Quince seeds are used medicinally only for the sake of their mucilage, which Dr Pereira, considering it to be peculiar, called *Cydonin.* The mucilage is abstracted by boiling water, and therefore a decoction has demulcent and emollient properties. The *Decoctum Cydoniæ* of the L. P. was made with one hundred and twenty grains of the seeds, boiled for ten minutes in a pint of distilled water, and strained. Its properties are similar to those of linseed tea; it does not keep well.

MYRTACEÆ—The Myrtle Order—Trees or shrubs inhabiting tropical and sub-tropical regions. Their medicinal properties are due to a pungent volatile oil; some of the plants possess astringent properties, and some yield gummy and saccharine matter. Officinal plants: *Caryophyllus aromaticus, Eugenia pimenta, Melaleuca minor, Punica Granatum.*

Caryophyllum—Cloves.—Officinal plant: *Caryophyllus aromaticus* Linn.; *Icosandria Monogynia;* the Clove Tree. Illustration, plates 2749, 2750, vol. liv. *Bot. Mag.* Officinal parts:—1. The unexpanded flower-bud, dried; cultivated in Penang, Bencoolen, and Amboyna. 2. *Oleum Caryophylli,* Oil of Cloves. The oil distilled in England from cloves. Officinal preparation: *Infusum Caryophylli;* it enters into *Infusum Aurantii Compositum, Mistura Ferri Aromatica,* and *Vinum Opii.*

Botany.—An elegant evergreen tree. *Stem,* fifteen to thirty feet in height. *Leaves,* about four inches long, tapering towards both ends, somewhat coriaceous, shining, minutely dotted. *Flowers,* fragrant, yellowish-red. *Fruit,* a purplish berry, elliptical, containing a solitary seed. *Habitat,* Molucca Islands; cultivated extensively in Amboyna Ternate, and elsewhere.

CHARACTERS.—*About six lines long, dark reddish-brown, plump, and heavy, consisting of a nearly cylindrical body surmounted by four teeth and a globular head, with a strong fragrant odour, and a bitter spicy pungent taste.*

PURITY TEST.—*It emits oil when indented with the nail.*

The clove is the unexpanded flower-bud of the plant, and owes its name to the resemblance which it bears to a nail, or *clou* of the French. The best cloves come from Amboyna, and are either collected by the hand or are beaten off with reeds, so as to fall upon cloths spread beneath the trees. They are dried either by the sun or by fire heat, and are imported in bags or casks. The Bourbon and Cayenne cloves from the French possessions are less esteemed than those from Penang, Bencoolen, and Amboyna, being smaller and less plump. Cloves contain a volatile oil, a resinous substance (caryophyllin), tannin, extractive, gum, &c. Cloves from which the volatile oil has been distilled may be substituted for the genuine article, hence the above purity test.

OLEUM CARYOPHYLLI—OIL OF CLOVES.—The oil distilled in Britain from cloves.

CHARACTERS.—*Colourless when recent, but gradually becoming red-brown, having the odour of cloves and a pungent spicy taste. Sinks in water.*

INFUSUM CARYOPHYLLI.—INFUSION OF CLOVES.—*Take of cloves, bruised,* $\frac{1}{4}$ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for half-an-hour, and strain.*

Dose.—Of the oil, two to eight or ten drops; of the infusion, half a fluid ounce to two fluid ounces.

Cloves have an aromatic taste and odour, and agree in their medicinal properties, in most respects, with the other spices, their activity depending chiefly upon the volatile oil. They are used as a condiment with food; medicinally, they act as stimulants, carminatives, and stomachics, but they are rarely given alone. They are chiefly employed to give flavour, and to act as corrective adjuncts to other medicines.

Pimenta—Pimento.—Officinal plant: *Eugenia pimenta,* D.C.; *Icosandria Monogynia;* the Allspice tree. Illustration, plate 26, *Woodv. Med. Bot.* Officinal parts:—1. The dried unripe berries; from the West Indies. 2. *Oleum Pimentæ,* Oil of Pimento; the oil distilled in England from Pimento. Officinal preparation: *Aqua Pimentæ.* Enters also into *Syrupus Rhamni.*

Botany.—A graceful evergreen tree, about thirty feet high. *Leaves,* about four inches long, smooth, oblong, or oval, pellucid, dotted. *Flowers,* numerous, petals greenish-white. *Fruit,* a succulent berry, purple when ripe. *Habitat,* West Indies; cultivated in Jamaica in regular walks, called "Pimento Walks."

CHARACTERS OF THE BERRIES.—*Of the size of a small pea, brown, rough, crowned with the teeth of the calyx, yellowish within, and containing two dark-brown seeds. Odour and taste aromatic, hot, and peculiar.*

CHARACTERS OF THE OIL.—*Colourless, or slightly reddish when recent, but becoming brown by age, having the odour and taste of pimento. Sinks in water.*

AQUA PIMENTÆ—Pimento Water.—*Take of pimento, bruised,* 14 *ounces; water,* 2 *gallons. Distil one gallon.*

Dose.—Of the water, one to two fluid ounces; of the oil, two to five or six drops.

Pimento—Allspice or Jamaica pepper—acts in accordance with its carminative, stimulant, and aromatic properties, which are derived from its volatile oil. It is not much used, and only as a flavouring or corrective adjunct or vehicle for other medicines.

Oleum Cajuputi—Oil of Cajuput—Officinal plant: *Melaleuca minor,* DC.; *Polyadelphia Icosandria;* the Cajuput tree. Illustration, plate 84, *Steph. and Church. Med. Bot.* (*M. cajuputi*). Officinal part: The oil, distilled from the leaves in the Molucca Islands. Officinal preparation: *Spiritus Cajuputi.*

Botany—A small tree, with an erect but crooked stem, covered with a softish light-coloured bark; branches scattered with slender twigs. *Leaves,* alternate; when full grown, three to five inches long. *Flowers,* white, in short terminal spikes.

Characters of the Oil.—*Very mobile, transparent, of a fine, pale bluish-green colour. It has a strong agreeable odour, and a warm aromatic taste, and leaves a sensation of coldness in the mouth.*

The oil of Cajuput or Kayaput is obtained by filling dry sacks with the leaves collected in autumn; whilst in the sack they become hot and damp; they are next macerated in water, and left to ferment for a night, and the oil is then distilled from them. The oil is usually imported in green glass bottles, and is itself green and transparent; it has a peculiar odour and an aromatic taste, somewhat resembling that of camphor. Several factitious oils have been substituted for it at seasons when its price was high; as in 1832, when it was extolled for its curative effects in cholera. It is said to be subject to impregnation with copper derived from the vessels in which it is prepared, and to this Guibourt attributed its green colour, but it is not likely, since many green specimens were found to contain no trace of copper. It is now generally pure.

SPIRITUS CAJUPUTI—Spirit of Cajuput.—*Take of oil of cajuput,* 1 *fluid ounce; rectified spirit,* 49 *fluid ounces. Dissolve.*

Dose.—Of the oil, two to ten minims, on sugar, or as an emulsion; of the spirit, one-half to one fluid drachm; externally, as a rubefacient.

Cajuput oil acts as a powerful diffusible stimulant, sudorific, and antispasmodic; it is allied in action to valerian and camphor, but does not produce mental disturbance in large doses as these do. It is not much used in this country; its reputation in cholera soon faded, and it is now only employed as a diffusible stimulant in cases requiring prompt rousing of the vital energies. It acts especially upon the nervous system, and is useful in low fevers, in paralytic affections, and in painful spasmodic affections, especially when these

are associated with hysteria. It is occasionally employed in rheumatism, as a stimulating sudorific. Externally, combined with olive oil, it is used as a rubefacient liniment.

Granati Radicis Cortex—Pomegranate Root.—Officinal plant: *Punica Granatum*, Linn.; *Icosandria Monogynia;* the Pomegranate. Illustration, plate 57, *Steph. and Church. Med. Bot.* Officinal part: The bark of the root, fresh or dried; obtained from the south of Europe. Officinal preparation: *Decoctum Granati Radicis.*

Botany.—A small tree with brownish bark. *Stem,* arborescent and irregular. *Leaves,* usually opposite, oblong-lanceolate, entire, smooth. *Flowers,* terminal on the young branches, commonly solitary, scarlet. *Fruit,* the size of a large apple, with a thick leathery rind: cells several, arranged in two strata, separated from each other by an irregular transverse diaphragm. *Seeds,* numerous, involved in pellucid pulp. *Habitat,* North of Africa, Syria, and Northern India; cultivated in Europe.

CHARACTERS OF THE ROOT-BARK.—*In quills or fragments of a greyish-yellow colour externally, yellow internally, having a short fracture, little odour, and an astringent slightly bitter taste.*

DECOCTUM GRANATI RADICIS—DECOCTION OF POMEGRANATE ROOT.—*Take of pomegranate root bark, sliced,* 2 *ounces; distilled water,* 2 *pints. Boil down to a pint, and strain, making the strained product up to a pint, if necessary, by pouring distilled water over the contents of the strainer.*

Dose as a Vermifuge.—After a dose of castor oil and a spare diet the day previously, the entire pint of the decoction is taken, in wine-glassful draughts at intervals of half-an-hour, the draughts being continued in spite of the nausea or vomiting which may ensue; the first dose should be given in the morning fasting.

Pomegranate is astringent in all its parts, due to the presence of tannin. In large doses the root-bark causes nausea and purging, and occasionally vomiting and vertigo. It has been recommended as a vermifuge in tape-worm, but it often fails to remove the worm. The rind of the fruit is occasionally used for the sake of its astringency in relaxed throats and mucous discharges. The ripe fruit may be eaten as a slightly astringent, refreshing refrigerant in febrile cases, especially of the bilious type.

CUCURBITACEÆ—The Gourd or Cucumber Order—Succulent climbing plants, chiefly inhabitants of hot climates, abounding in India and South America. The plants generally possess acrid, bitter, and drastic properties, but many of the cultivated fruits are edible. Officinal plants: *Citrullus Colocynthis, Ecbalium officinarum.*

Colocynthidis Pulpa — Colocynth. — Officinal plant: *Citrullus Colocynthis,* Schrad.; *Monœcia Syngenesia;* the Bitter Cucumber, Bitter Apple, or Colocynth. Illustration, plate 175, *Woodv. Med. Bot.* (*Cucumis Colocynthis*). Officinal part: The dried decorticated fruit,

freed from the seeds; imported chiefly from Smyrna, Trieste, France, and Spain. Officinal preparation: *Extractum Colocynthidis Compositum, Pilula Colocynthidis et Hyoscyami, Pilula Colocynthidis Composita.*

Botany.—Annual herb. *Root,* annual, white, branched. *Stem,* herbaceous, branched, procumbent. *Leaves,* cordate-ovate, many-lobed, bright green on the upper surface, but paler underneath, where they are also hirsute. *Tendrils,* filiform, branching, given off opposite each leaf. *Flowers,* axillary; petals, small and yellow, with greenish veins. *Fruit,* a pepo, about the size of an orange, globose, smooth, and yellow when ripe, with a thin but solid rind, six-celled. *Seeds,* ovate; pulp, bitter. *Habitat,* southern shores of the Mediterranean, Japan, Coromandel Coast, Cape of Good Hope, &c.; cultivated in Spain and France.

CHARACTERS.—*Light spongy white or yellowish-white in colour, intensely bitter in taste.*

The fruit is gathered in autumn, when ripe and yellow. As imported, it is either peeled or unpeeled; its pulp is nearly white, is inodorous, but has a very bitter taste; the seeds of the pepo are smooth, and vary in colour from white or yellowish-white to brown. Two kinds of colocynth are recognised in commerce, namely, Turkey and Mogadore, or peeled and unpeeled. Turkey, or peeled, colocynth is imported from Smyrna, Constantinople, Alexandretta, &c., and there is also a peeled variety imported from Spain and France. The Turkey variety is larger, more plump, and about double the value of the Spanish. They are about three inches in diameter, more or less round, whitish, and bear the marks made in cutting away the rind. Mogadore, or unpeeled, colocynth is not largely imported, and is but little employed for medicinal purposes. The fruit is larger than the Turkey variety, and bears a smooth, yellow, hard rind. The active principle of colocynth, termed *colocynthin,* lies in the pulp; it is a bitter yellowish-brown, translucent, friable substance, soluble in water and in alcohol, but not in ether. In its chemical nature it is allied to the Glycosides, and has the probable formula ($C_{56}H_{84}O_{23}$).

EXTRACTUM COLOCYNTHIDIS COMPOSITUM—COMPOUND EXTRACT OF COLOCYNTH.—*Take of colocynth pulp,* 6 *ounces; extract of socotrine aloes,* 12 *ounces; resin of scammony,* 4 *ounces; hard soap, in powder,* 3 *ounces; cardamom seeds, in fine powder,* 1 *ounce; proof spirit,* 1 *gallon. Macerate the colocynth in the spirit for four days; press out the tincture and distil off the spirit, then add the aloes, scammony, and soap, and evaporate by a water-bath until the extract is of a suitable consistence for forming pills, adding the cardamoms towards the end of the process.*

PILULA COLOCYNTHIDIS COMPOSITA—COMPOUND PILL OF COLOCYNTH.—*Take of colocynth pulp, in powder,* 1 *ounce; Barbadoes aloes, in powder; scammony, in powder, of each,* 2 *ounces; sulphate of potash, in powder,* ¼ *ounce; oil of cloves,* 2 *fluid drachms; distilled water, a sufficiency. Mix the powders, add the oil of cloves, and beat into a mass with the aid of the water.*

PILULA COLOCYNTHIDIS ET HYOSCYAMI—PILL OF COLOCYNTH AND HYOSCYAMUS—*Take of compound pill of colocynth,* 2 *ounces; extract of hyoscyamus,* 1 *ounce. Beat them into a uniform mass.*

Dose.—Of powdered colocynth (rarely used), two to six or eight grains, mixed with some inert powder, such as gum or starch ; of the compound extract, five to ten grains ; of the compound pill, five to ten grains ; of the colocynth and hyoscyamus pill, five to ten grains, or better, one to three pills containing each two grains.

Colocynth in small doses, and in one of the above combined forms, is a useful purgative, acting both on the muscular and secreting structures of the bowels, and giving an impetus to the abdominal viscera generally. It also acts somewhat as a diuretic. In large doses it is a powerful hydragogue and drastic cathartic. In excessive doses it proves fatal by causing gastro-intestinal inflammation, attended with severe griping and most excruciating pains. Professor Christison mentions a case in which a teaspoonful and a-half, or about ninety grains, of the powder proved fatal. Colocynth acts chiefly upon the large intestines, not only as a topical irritant, but also by the absorption of its active principle into the circulation. It also stimulates the pelvic viscera. It is useful as a purgative in habitual constipation, in amenorrhœa, chlorosis, &c., as a derivative in head cases, as a hydragogue in dropsies &c. It is contra-indicated in abdominal inflammations, in pregnancy, in menorrhagia, &c. Opiates, poultices to the abdomen, diluents, and demulcents, may be given when the poisonous results of colocynth supervene.

Elaterium—Elaterium.—*Synonym: Extractum Elaterii,* Lond. Officinal plant : *Ecbalium officinarum,* Richard ; *Monœcia Syngenesia ;* the Squirting Cucumber. Illustration, plate 34, *Steph. and Church. Med. Bot.* Officinal part : A sediment from the expressed juice of the fruit.

Botany.—Annual. *Stem,* trailing, hispid, scabrous, glaucous, without tendrils, *Leaves,* on long bristly stalks, cordate, somewhat lobed, crenately-toothed. *Flowers,* axillary, monœcious, yellow. *Fruit,* a pepo, muricated, elliptical, one inch and a-half long. When ripe it separates from its stalk, and forcibly ejects its juice and seeds through the basilary aperture at the point which was previously in contact with the stalk, hence called *squirting* cucumber. *Seeds,* brown, compressed, reticulate. *Habitat,* south of Europe ; cultivated at Hitchin and Mitcham.

Preparation.—*Take of squirting cucumber fruit, very nearly ripe,* 1 *pound. Cut the fruit lengthwise, and lightly press out the juice. Strain it through a hair sieve, and set it aside to deposit. Carefully pour off the supernatant liquor ; pour the sediment on a linen filter, and dry it on porous tiles with a gentle heat. The decanted fluid may deposit a second portion of sediment, which can be dried in the same way.*

Characters.—*In light friable slightly incurved cakes, about one line thick, greenish-grey, acrid and bitter ; fracture finely granular.*

Purity Tests.—*Does not effervesce with acids ; yields half its weight to*

boiling rectified spirit. This solution, concentrated and added to warm solution of potash, yields on cooling not less than twenty per cent. of elaterine in colourless crystals.

The active principle of the fruit exists only in the juice which surrounds the seeds. The finest variety of elaterium is obtained by gathering the fruit as nearly ripe as it is safe to leave it, lest it should burst spontaneously. There are several varieties of elaterium, but two only are distinguished in commerce, namely, English and Maltese. English elaterium is of two qualities : the finer kind is light and friable, in thin laminæ or cakes, and marked by the fibres of the linen upon which it was dried. It is at first greenish-gray, but becomes yellow on exposure; it has a peculiar faint odour, and an acrid, bitter taste. The inferior kind is often hard and tenacious, not easily broken, and contains a good deal of mucilaginous matter, which is deposited with the fecula if proper care be not taken in the manufacture. The inferior kind is often prepared from the juice that remains after the finer kinds have been extracted. Maltese elaterium, imported from Malta, is usually in larger flakes, and is paler in colour, than the English kind, and has often pieces of the paper upon which it was dried adhering to it. It is not a trustworthy kind, being often mixed with chalk and starch, and with syrup of buckthorn to darken its colour. The more important constituents of elaterium are elaterin, green resin, bitter matter, &c. Elaterine ($C_{20}H_{28}O_5$), the active principle of elaterium, may be separated by the process mentioned in the above purity test. It occurs in colourless rounded prismatic crystals, of silky appearance, is insoluble in water, but soluble in hot alcohol ; it is neutral to test-paper, is inodorous, but has an intensely bitter taste, and is of the nature of a glycoside. Good elaterium should yield not less than from twenty to twenty-five per cent. of elaterine. If chalk be present it will effervesce with acids.

Dose.—One-sixteenth to one-half of a grain. It frequently happens that, from the comparative inertness of the drug, arising either from adulteration or faulty preparation, a small dose produces but little effect, nevertheless it is always necessary to begin cautiously, and to increase the dose in accordance with the quality of the sample employed. It may be given in the form of pill with a tonic extract, such as that of gentian.

Elaterium acts topically as an irritant. Those who prepare it suffer from inflammation and ulceration of the fingers produced by handling the sliced fruit, and when the juice accidentally comes in contact with the conjunctiva it causes intense pain and inflammation. Internally it acts topically by irritating the mucous membrane of the stomach and bowels, causing both vomiting and purging. One-eighth of a grain of good elaterium purges violently, equal to the effects produced by one-sixteenth to one-twelfth of a grain of elaterin ; but the elaterium of the shops is seldom quite pure, and about double that quantity is required for a full dose. It is a violent drastic, hydragogue cathartic, causing severe griping and numerous liquid evacuations. It is chiefly employed in passive

dropsies; it is prompt, energetic, and certain in its effects, and reduces the effused fluid more effectually than any other remedy of its class. It may be given either in one full dose, taking care to support the patient during its operation, or in smaller doses repeated on alternate days or twice a-week. It is contra-indicated in cases complicated with inflammatory symptoms of the stomach, or bowels, and also in extreme debility. It is occasionally employed as a derivative in head cases, and as an active purgative in obstinate constipation. It has been recommended also in certain forms of gout, but its chief employment is in dropsies. Opiates, demulcent drinks and enemata, and poultices or fomentation to the abdomen may be used to allay the effects of an over-dose; at the same time, whilst antiphlogistic measures are employed to reduce local inflammation, the patient must be supported by suitable stimulants.

UMBELLIFERÆ or APIACEÆ—The Umbelliferous Order—Herbs or small shrubs, with solid or hollow stems, inhabiting the northern parts of the northern hemisphere, and a corresponding elevation upon the high mountains of the tropics. The properties of the plant are various; some are edible, some act as acro-narcotic poisons, some as stimulants and tonics due to a volatile oil, others as antispasmodics due to the presence of a fetid gum-resin. Officinal plants: *Carum carui, Pimpinella anisum, Fœniculum dulce, Anethum graveolens, Coriandrum sativum, Narthex assafœtida, Dorema ammoniacum, Conium maculatum, Sumbul Radix.*

Carui Fructus—Caraway.—Officinal plant: *Carum Carui*, Linn.; *Pentandria Digynia;* common caraway. Illustration, plate 45, *Woodv. Med. Bot.* Officinal parts:—1. The fruit dried; cultivated in England and Germany. 2. *Oleum Carui*, Oil of Caraway; the oil distilled in England from caraway. Officinal preparation: *Aqua Carui.*

Botany.—Biennial. *Root,* fusiform. *Stem,* branched, about two feet high. *Leaves,* bipinnate. *Flowers,* white or pale flesh-colour. *Mericarps,* or seeds, as they are commonly called, one and a-half to two lines long, slightly curved inwards, with five primary ridges of a lighter colour than the rest, which is brownish; they have a peculiar aromatic agreeable odour, and a warm taste, due to a volatile oil contained in the vittæ or little cells. *Habitat,* meadows and pastures throughout Europe; cultivated in Essex.

Characters of the Fruit or Mericarp.—*Fruit usually separating into two parts, which are about two lines long, curved, tapering at each end, brown, with five paler longitudinal ridges; having an agreeable aromatic odour, and a spicy taste.*

Characters of the Oil.—*Colourless or pale yellow, odour aromatic, and taste spicy.*

The fruit, commonly called caraway seeds, yields about five per cent.

of the volatile oil by distillation with water. The oil is apt to turn yellow, and ultimately brown by keeping.

AQUA CARUI—CARAWAY WATER.—*Take of caraway fruit, bruised, 1 pound; water, 2 gallons. Distil one gallon.*

Dose.—Of the oil, one to five or ten minims; of the water, one to three fluid ounces.

Caraway seeds are chiefly used in confectionery. As a medicine, caraway is aromatic, carminative, and somewhat stimulant. The oil and the water are chiefly used as corrective and flavouring adjuncts or vehicles to other medicines, and occasionally to relieve the flatulent colic of children.

Oleum Anisi—Oil of Anise.—Officinal plants:—1. *Pimpinella Anisum*, Linn.; *Pentandria Digynia;* the Anise. Illustration, plate 180, page 490, *Woodv. Med. Bot.* Officinal part: The oil, distilled from the fruit in Europe. *Illicium anisatum*, Linn.; *Polyandria Octogynia, Magnoliaceæ;* the Star Anise. Illustration, plate 369, *Nees Plant. Med.* Officinal part: The oil, distilled from the fruit in China. Officinal preparation: *Essentia Anisi.* The oil enters into *Tinctura Camphoræ composita* and *Tinctura Opii Ammoniata.*

Botany.—1. *Pimpinella Anisum.* Annual. *Root,* tapering. *Stem,* erect, smooth, branching, about one foot high. *Leaves,* various; radical leaves, cordate; stem leaves, middle ones pinnate, lobed; upper leaves, trifid, undivided, and linear. *Flowers,* small and white. *Habitat,* Egypt, Grecian Archipelago; cultivated in many parts of Europe. 2. *Illicium anisatum,* a shrub about eight feet high, with evergreen, obovate, dotted leaves, and yellow solitary flowers. *Habitat,* China and Japan.

CHARACTERS OF THE OIL.—*Colourless or pale yellow; with the odour of anise, and a warm sweetish taste. Concretes at* 50°.

The fruit, commonly called aniseed, is laterally compressed, ovate, with a few scattered hairs, and five primary ridges; it has an agreeable aromatic odour, and warm taste, imparted by the volatile oil. The oil prepared from *Pimpinella anisum* congeals at 50°, and does not become fluid again until it reaches 62°; the oil of Star-anise, now an acknowledged adulteration of the farmer, retains its fluidity at a temperature much below 50°. Spermaceti and camphor are sometimes added to promote the solidification of the oil.

ESSENTIA ANISI—ESSENCE OF ANISE.—*Take of oil of anise,* 1 *fluid ounce; rectified spirit,* 4 *fluid ounces. Mix.*

Dose.—Of the oil, two to five or eight drops upon sugar, or rubbed up with sugar in camphor water, or other vehicles; of the essence, ten to twenty minims.

Oil of anise acts as an aromatic, carminative, and stimulant. It is used as a corrective and flavouring adjunct to other medicines, and in the flatulent colic of children. It is employed also in confectionery.

Fœniculi Fructus—Fennel Fruit. Officinal plant: *Fœniculum dulce*, DC.; *Pentandria Digynia;* Sweet Fennel. Officinal part: The fruit, imported from Malta. Officinal preparation: *Aqua Fœniculi.*

Botany.—Annual. *Stem*, somewhat compressed at the base. *Radical leaves*, somewhat distichous. *Flowers*, yellow; umbels of six to eight rays.

CHARACTERS OF THE FRUIT.—*About three lines long and one line broad; elliptical, slightly curved, beaked, having eight pale-brown longitudinal ribs, the two lateral being double; taste and odour aromatic.*

The medicinal properties of the fruit depend upon a volatile oil, which is more agreeable than that which is contained in the fruit of *Fœniculum vulgare*, the common or wild Fennel.

AQUA FŒNICULI—FENNEL WATER.—*Take of fennel fruit, bruised,* 1 *pound; water,* 2 *gallons. Distil one gallon.*

Dose.—Of the water, from a fluid drachm for an infant to one or more fluid ounces for an adult.

Fennel acts as a carminative, and is occasionally given in the flatulent colic of children, or as a vehicle for other medicines, but is comparatively rarely used.

Anethi Fructus—Dill Fruit.—Officinal plant: *Anethum graveolens*, Linn.; *Pentandria Digynia;* Common Garden Dill. Illustration, plate 159, *Woodv. Med. Bot.* Officinal parts:—1. The fruit cultivated in England, or imported from middle and southern Europe. 2. *Oleum Anethi*, Oil of Dill; the oil distilled in Britain from Dill fruit. Officinal preparation: *Aqua Anethi.*

Botany.—Annual. *Root*, long and tapering. *Stem*, eighteen inches to two feet high, smooth, finely striated, and simply branched. *Flowers*, yellow; umbels long, stalked. *Habitat*, south of Europe, Egypt, &c.; cultivated in England.

CHARACTERS OF THE FRUIT.—*Oval, flat, about a line and a-half in length, with a pale membranous margin. Odour aromatic, taste warm, somewhat bitter.*

CHARACTERS OF THE OIL.—*Colour pale yellow, odour pungent, taste acrid, sweetish.*

AQUA ANETHI—DILL WATER.—*Take of dill fruit, bruised,* 1 *pound; water,* 2 *gallons. Distil one gallon.*

Dose.—Of the water, from one fluid drachm for an infant, to one or more fluid ounces for an adult.

Dill acts as an aromatic stimulant, and is employed as a corrective and flavouring adjunct or vehicle to other remedies, and occasionally in the flatulent colic of children.

Coriandri Fructus—Coriander. Officinal plant: *Coriandrum sativum*, Linn.; *Pentandria Digynia;* the Coriander. Illustration, plate 181,

Woodv. Med. Bot. Officinal parts :—1. The ripe fruit dried; cultivated in Britain. 2. *Oleum Coriandri,* Oil of Coriander; the oil distilled in Britain from Coriander fruit. Coriander enters into confection of senna, gentian mixture, syrup of rhubarb, tincture of rhubarb, and tincture of senna, and the oil into syrup of senna.

Botany.—Annual. *Stem,* erect, smooth, striated, eighteen inches to two feet high. *Leaves,* bipinnate. *Flowers,* white, or with a reddish tinge. *Habitat,* south of Europe; met with wild, and also cultivated in Essex.

Characters of the Fruit.—*Globular, nearly as large as white pepper, beaked, finely ribbed, yellowish-brown; has an agreeable aromatic odour and flavour.*

Characters of the Oil.—*Yellowish, having the odour of coriander.*

The properties of the fruit, commonly called coriander seeds, depend upon the volatile oil.

Dose.—Of the fruit, thirty to sixty grains; of the oil, two to five drops.

Coriander is used only as a corrective and flavouring adjunct to other remedies, and is said to be especially useful in disguising the taste and odour of senna.

The root of *Angelica Archangelica,* or *Archangelica officinalis,* was formerly officinal: in doses of ten to thirty grains of the powdered, or thirty to sixty or more grains of the bruised root, it acts as an aromatic stimulant and carminative, these properties depending upon a volatile oil. It is seldom used. The fruit of *Cyminum Cuminum,* common Cumin, was formerly officinal. In doses of ten to thirty grains it acts as an aromatic stimulant and carminative, but is rarely used. *Emplastrum Cumini* was officinal, and employed as a stimulant to indolent sores. The fresh root of *Daucus Carota,* the cultivated carrot, was formerly officinal. Its chief medicinal use is to make a cleansing and soothing poultice.

Assafœtida—Assafœtida.—Officinal plant: *Narthex assafœtida,* Falconer in *Royle's Mat. Med.; Pentandria Digynia;* the Assafœtida Plant. Illustration, plates 20, 21, vol. xxii. *Edinb. Roy. Soc. Trans.* Officinal part: *A gum-resin,* obtained by incision from the living root, in Affghanistan and the Punjaub. Officinal preparations: *Enema Assafœtidæ, Pilula Aloes et Assafœtidæ, Pilula Assafœtidæ Composita, Spiritus Ammoniæ Fœtidus, Tinctura Assafœtidæ.*

Botany.—Perennial, five to eight feet high. *Root,* heavy and tapering, about three inches in diameter at the summit, and covered with a blackish-coloured root-bark; internally, it is white and fleshy, and abounds in a milky juice, which has the fetid odour of the gum-resin. *Stem,* rises from the midst of the radical-leaves, is smooth, and at the base about six to eight inches in circumference; it is erect, herbaceous, striated, solid, and roundish, from six to nine feet high, terminating in a luxuriant head of compound umbels. *Radical-leaves,* nearly two feet long, three-parted, with bipinnatifid segments. *Fruit,* flat, thin, oval, reddish-brown. *Habitat,* Persia, Affghanistan, Punjaub.

CHARACTERS OF THE GUM-RESIN.—*In irregular masses, partly composed of tears, moist or dry. The colour of a freshly cut or broken piece is opaque white, but gradually becomes purplish-pink, and ultimately dull-yellowish or pinkish-brown. Taste bitter, acrid; odour fetid, alliaceous and persistent. It dissolves almost entirely in rectified spirit.*

The gum-resin is obtained from the root in this way: the earth is first cleared away from the upper part of the root, and with it the leaves and fibres, about the middle of April; then near the end of May, the root in the meantime having been protected from the sun's rays by leaves spread over it, the collectors slice off the top of the root transversely with a sharp knife; the cut surface is again protected from the sun by a covering of leaves until the third day, when the juice which has escaped is scraped off by means of a broad iron spatula, and is placed in cups and baskets; this process is repeated a second and third time by cutting away fresh slices of the root. The juice is hardened by exposure to the sun. Several varieties of assafœtida are recognised in commerce, the chief of which are assafœtida in tears, lump assafœtida, and stony assafœtida. The better kind has the characters above mentioned. The active constituents of assafœtida are volatile oil, resin, and gum. The volatile oil may be obtained by distilling the gum-resin with water and alcohol; it is soluble in alcohol and ether, but scarcely at all in water; when fresh it is colourless, but soon becomes yellowish; it becomes acid by exposure to the atmosphere, readily evaporates, and fills the air with its peculiar odour; when boiled it evolves sulphuretted hydrogen. The odour of the gum-resin is due to this oil. Resin of assafœtida is soluble in alcohol, but in water it is merely held in suspension as an emulsion by the gum. Assafœtida is a good deal exposed to adulteration with dirt, stones, flour, gypsum, &c.

ENEMA ASSAFŒTIDÆ—ENEMA OF ASSAFŒTIDA.—*Synonym:* Enema fœtidum, *Edin. Dub.*—*Take of assafœtida,* 30 *grains; distilled water,* 4 *fluid ounces. Rub the assafœtida in a mortar with the water added gradually, so as to form an emulsion.*

PILULA ASSAFŒTIDÆ COMPOSITA—COMPOUND PILL OF ASSAFŒTIDA.—*Synonym:* Pilula Galbani composita, *Lond.*—*Take of assafœtida; galbanum; myrrh, of each* 2 *ounces; treacle, by weight,* 1 *ounce. Heat all together by means of a water-bath, and stir the mass until it assumes a uniform consistence.*

TINCTURA ASSAFŒTIDÆ—TINCTURA OF ASSAFŒTIDA—*Take of assafœtida, in small fragments,* 2½ *ounces; rectified spirit, a sufficiency. Macerate the assafœtida in fifteen fluid ounces of the spirit for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient reccified spirit to make one pint.*

Dose.—Of the gum-resin, five to twenty or more grains, in pills or emulsion; of the enema, the quantity prescribed above; of the compound pill, five to twenty grains; of the tincture, thirty minims to two or more fluid drachms.

Assafœtida acts as a stimulant and antispasmodic. It is contra-indicated in inflammatory disorders, and where there is irritation of

the alimentary mucous membrane, in consequence of its general and topical stimulating effects. It is employed as an antispasmodic in convulsive disorders, especially those complicated with hysteria, in spasmodic nervous diseases of females, in chorea, epilepsy, uncomplicated fits of hysteria, &c. It has been successfully used in whooping-cough; but children struggle against it in consequence of its offensive odour and taste. It is given also as a stimulating expectorant in spasmodic catarrh, especially in chronic cases of the aged. The enema is useful in hysteria, in constipation with flatulence and nervous colicky pains, and in infantile convulsions; also to remove the tympanitic condition of the abdomen in low fevers.

Ammoniacum—Ammoniacum.—Officinal plant: *Dorema Ammoniacum*, Don, *Trans. Linn. Soc.; Pentandria Digynia;* the Ammoniacum Plant. Officinal part: A gum-resinous exudation from the stem; collected in Persia and the Punjaub. Officinal preparations: *Emplastrum Ammoniaci cum Hydrargyro, Emplastrum Galbani, Mistura Ammoniaci, Pilula Scillæ Composita, Pilula Ipecacuanhæ cum Scilla.*

Botany.—Perennial herb, seven to nine feet high. *Stem,* smooth, glaucous, green, about four inches in circumference at the base. *Leaves,* large, petiolate, about two feet long. *Flowers,* white. *Fruit,* slightly compressed from the back, with primary and secondary ridges, and many vittæ, one to each of the primary and secondary ridges, and four to the commissure. *Habitat,* Persia and the Punjaub.

Characters of the Gum-Resin.—*In tears or masses; the tears from two to eight lines in diameter, pale cinnamon-brown, breaking with a smooth shining opaque white surface; the masses composed of agglutinated tears; hard and brittle when cold, but readily softening with heat; has a faint odour, and a bitter, acrid, nauseous taste. Rubbed with water it forms a nearly white emulsion.*

The ammoniacum plant abounds in a milky juice, which exudes from the slightest puncture either of the stem or leaves. This juice, when exposed to the atmosphere, hardens into the gum-resin ammoniacum. Incisions are scarcely necessary to the exudation of the juice. According to Kennet, it exudes freely through wounds made by numbers of beetles, which pierce the plant at all parts when it has attained maturity. When the exuded tears dry and harden, they are scraped off and collected. Ammoniac is met with in tears and in lumps, and has the characters above mentioned. It is called strained ammoniac, or *Ammoniacum colatum,* when strained to remove impurities, which it often contains in pretty large quantity. The active constituents of ammoniac are volatile oil, resin, and gum: the oil is transparent and light; the resin is reddish-yellow, and is soluble in alkalies, alcohol, and partially in ether; in water it is suspended by means of the gum.

EMPLASTRUM AMMONIACI CUM HYDRARGYRO—Ammoniacum and Mercury Plaster.—Preparation—*Take of ammoniacum,* 12 *ounces; mercury,* 3 *ounces*; *olive oil,* 1 *fluid drachm; sublimed sulphur,* 8

grains. Heat the oil, and add the sulphur to it gradually, stirring till they unite. With this mixture triturate the mercury, until globules are no longer visible; and, lastly, add the ammoniacum previously liquefied, mixing the whole carefully.

MISTURA AMMONIACI—AMMONIACUM MIXTURE.—PREPARATION—*Take of ammoniacum, in coarse powder,* $\frac{1}{4}$ *ounce; distilled water,* 8 *fluid ounces. Triturate the ammoniacum with the water, gradually added, until the mixture assumes a milky appearance, then strain through muslin.*

Dose.—Of the gum-resin, ten to thirty grains in pills or emulsion; of the mixture, half-a-fluid ounce to one fluid ounce.

Ammoniac acts like the other fetid gum-resins, but much less powerfully than assafœtida or galbanum, probably because it contains less volatile oil. It is not much employed internally, but may be given in certain chronic pulmonary affections, such as the catarrh and asthmatic affections of old people. Its chief use is in the form of the plaster, as a stimulant application to chronic affections of the joints, and glandular enlargement. The plaster sometimes causes considerable local irritation, followed occasionally by a papular eruption.

Galbanum—Galbanum.—A gum-resin, derived from an unascertained umbelliferous plant; imported from India and the Levant. Officinal preparations: *Emplastrum Galbani, Pilula Assafœtidæ Composita.*

CHARACTERS.—*In irregular tears, about the size of a pea, usually agglutinated into masses, of a greenish-yellow colour, translucent, having a strong, disagreeable odour, and an acrid, bitter taste.*

The source of galbanum is still undetermined; the following plants have been named by different authorities as those from which it is probably obtained—*Galbanum officinale, Opoïdia galbanifera,* and *Ferula erubescens.* Galbanum is met with in two forms—in tears, and in lumps; the former kind has the above characters. Lump galbanum is more commonly met with; it is of a dark brownish-yellow colour externally, and of pearly whiteness, or of a bluish tinge when freshly fractured; it is made up of agglutinated tears, mixed with parts of the fruit and pieces of the stem of the plant from which it is obtained. Volatile oil of galbanum may be obtained by distilling the gum-resin with water; it is colourless and limpid, has the odour of galbanum, a hot acrid taste, and is soluble in alcohol, in ether, and in the fixed oils. Resin of galbanum is soluble in ether and in alcohol; it is dark-brown, transparent, and brittle.

EMPLASTRUM GALBANI—GALBANUM PLASTER.—PREPARATION.—*Take of galbanum; ammoniacum; yellow wax, of each* 1 *ounce; lead plaster,* 8 *ounces. Melt the galbanum and ammoniacum together, and strain. Then add them to the lead plaster and wax, also previously melted together, and mix the whole thoroughly.*

Dose.—Of the gum-resin, five to twenty grains in pill or emulsion; it is usually given in combination with assafœtida, as in the compound assafœtida pill.

Galbanum acts as a stimulant and antispasmodic, less energetic than assafœtida, but more so than ammoniacum. The Germans call it Mütter harz (uterine rezin), from its supposed specific stimulant action upon the uterus. Like the other gum-resins, it is contra-indicated in states of irritation and inflammation, and is chiefly used in nervous and torpid conditions of the system. It has been found useful in those cases in which assafœtida is employed, and is generally associated with it. It has been used with advantage in chronic mucous catarrh, in amenorrhœa, in chronic rheumatism, &c. Externally, in the form of plaster, it is employed as a stimulant and resolvent application to indolent tumours; also to the chest in pulmonary affections, and to the lumbar regions in weakness of the lower extremities.

Opopanax formerly enjoyed a high medicinal reputation, but is no longer officinal. The plant which yields it, probably *Opopanax chironum*, is found in the south of Europe. This gum-resin is also met with in the two forms of tears and lumps. It is of a yellowish-red colour, has an unpleasant odour, and a bitter acrid taste. Its actions and uses are similar to those of the other fetid gum-resins, but it is seldom employed.

Conium—Hemlock.—Officinal plant: *Conium maculatum,* Linn.; *Pentandria Digynia;* Spotted Hemlock. Illustration, plate 17, fasc. ii. *Flor. Lond.* Officinal parts:—1. *Conii Folia.* The fresh leaves and branches of wild British plants, gathered when the fruit begins to form; and the leaves dried in the sun, or at a temperature not exceeding 120° 2. *Conii Fructus.* The ripe fruit; dried. Officinal preparation: *Cataplasma Conii, Extractum Conii, Succus Conii, Pilula Conii Composita; Tinctura Conii Fructus, Vapor Coniœ.*

Botany.—*Root,* biennial, tap-shaped, fusiform, whitish, six to twelve inches long. *Stem,* round, smooth, glaucous, shining, spotted, hollow, two to six feet high; the spots are dark purple. *Leaves,* tripinnate, with lanceolate pinnatifid leaflets, which are dark-green, shining and smooth, and emit a disagreeable odour when bruised. *Umbels* consist of general and partial rays. *Fruit,* ovate, compressed laterally; the seed has a deep hollow groove in front. *Habitat,* hedge-rows and waste places in this and other European countries; also in North America and Eastern Asia.

Characters of the Leaves.—*Fresh leaves decompound, smooth, arising from a smooth stem with dark purple spots; dried leaves of a full green colour and characteristic odour. The leaf rubbed with solution of potash gives out strongly the odour of conia.*

Characters of the Fruit.—*Broadly ovate, compressed laterally; half-fruit with five-waved or crenated ridges; reduced to powder, and rubbed with solution of potash, they give out strongly the odour of conia.*

The more important constituents of hemlock are a volatile oil, and an alkaloid termed *conia.* The volatile oil is the odorous, but not the active principle of the plant, as is shown by the fact, that whilst the distilled water, which contains the oil, has the odour of hemlock, it has none of its poisonous properties; and it has been proved that the power of the odour is no measure of the medicinal strength of any specimen of hemlock. *Conia, Coneïn, Conicin,* or *Cicutine* (C_8NH_{15}), the active principle of the plant exists more largely in the fruit than in the leaves, but probably more or less in all parts of the plant. It exists in combination with the coniic acid of Peschier, forming a compound which has not the characteristic odour of the alkaloid, and it requires the presence of an alkali to facilitate its isolation. Conia may be obtained by distilling the soft or syrupy alcoholic extract of the fruit with its own weight of water and a little caustic potash; the conia passes over and floats upon the water. In its pure state, it is a light oily, transparent liquid, with a strong penetrating odour, and an acrid taste. The vapour, when permitted to come in contact with the conjunctiva, causes a flow of tears. Conia may be recognised by its peculiar odour, by being liquid at ordinary temperatures, by its volatility, by its alkaline reaction with turmeric paper, and by giving white fumes of hydrochlorate of conia with the vapour of hydrochloric acid, &c.

CATAPLASMA CONII — HEMLOCK POULTICE.—*Take of hemlock leaf, in powder,* 1 *ounce; linseed meal,* 3 *ounces; boiling water,* 10 *fluid ounces. Mix the hemlock and linseed meal, and add them to the water gradually, with constant stirring.*

EXTRACTUM CONII—EXTRACT OF HEMLOCK.—*Take of the fresh leaves and young branches of hemlock,* 112 *pounds. Bruise in a stone mortar, and press out the juice; heat it gradually to* 130°, *and separate the green colouring matter by a calico filter. Heat the strained liquor to* 200° *to coagulate the albumen, and again filter. Evaporate the filtrate by a water-bath to the consistence of a thin syrup; then add to it the green colouring matter previously separated, and stirring the whole together assiduously, continue the evaporation at a temperature not exceeding* 140°, *until the extract is of a suitable consistence for forming pills.*

Pilula Conii Composita—Compound Pill of Hemlock.

PREPARATION.—*Take of extract of hemlock,* 2½ *ounces; ipecacuanha in powder,* ½ *ounce; treacle, a sufficiency. Mix the extract of hemlock and ipecacuanha, and add sufficient treacle to form a pill mass.*

Antispasmodic, sedative, and expectorant. It is employed in spasmodic cough, bronchitis, and especially in the troublesome irritating cough of the early stage of phthisis. Adopted from the London Pharmacopœia.

SUCCUS CONII—JUICE OF HEMLOCK.—*Take of fresh leaves of hemlock,* 7 *pounds; rectified spirit, a sufficiency. Bruise the hemlock in a stone mortar; press out the juice; and to every three measures of juice add one of the spirit. Set aside for seven days, and filter. Keep it in a cool place.*

TINCTURA CONII—TINCTURE OF HEMLOCK FRUIT.—*Synonym:* Tinctura Conii Fructus. *Take of hemlock fruit bruised,* $2\frac{1}{2}$ *ounces; proof spirit,* 1 *pint. Macerate the hemlock fruit for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and, when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Vapor Coniæ—Inhalation of Conia.

PREPARATION.—*Take of extract of hemlock,* 60 *grains; solution of potash,* 1 *fluid drachm; distilled water,* 10 *fluid drachms. Mix. Put twenty minims of the mixture on a sponge, in a suitable apparatus, so that the vapour of hot water passing over it may be inhaled.*

By the action of the potash on the extract of hemlock, the volatile alkaloid is set free and diffused in the vapour of the water as is passes over the sponge. But, owing to the exceedingly small amount of conia contained in the extract, this inhalation must be almost inert.

Dose.—The Pharmacopœia recommends of the extract two to six grains; of the juice, one-half to one fluid drachm; of the tincture, twenty to sixty minims; of the compound pill, five to ten grains. The able researches of Dr John Harley, however, prove that the only trustworthy preparations of hemlock are the succus conii and the alkaloid conia. The dried fruit and dried plant seem both almost entirely inert. Even the extract of the fresh plant, prepared by the process given above, was found by the same observer never to contain much over one per cent. of the active principle, conia. The usual test of judging the genuineness of a hemlock preparation, namely, the odour of conia given forth on the addition of caustic potash, is found by Dr Harley exceedingly fallacious, inasmuch as a quantity of conia, so small as to render the preparation useless in a therapeutic point of view, gives out a distinct odour of the alkaloid. The tincture Dr Harley found completely inert, except in so far as it possessed the stimulating effects of the alcohol used in its preparation. Conia itself may be administered in doses of one-fiftieth to one-twelfth of a grain, but it is unsuitable for internal use, since it is apt to induce symptoms of gastro-intestinal irritation when administered by the mouth, and to act as a local irritant when injected subcutaneously. The only really useful preparation is therefore the succus, which Dr Harley, from extensive trial, recommends in the following doses:—For a child six months old, twenty to thirty drops; over two years old, one drachm; ten years old, one to two drachms. For a woman, two to three drachms; for a man, four to five drachms. Instead of the vapor coniæ, Dr Harley recommends a solution of gr. ii. of conia in ℨiii. of alcohol and ℨv. of water: twenty minims of such solution contain one-twelfth of a grain of conia, and, if dropt into water, form a suitable amount for inhalation.

Antidotes.—No chemical antidote: remove the poison from the stomach by emetics or the stomach-pump; and from the bowels by a dose of castor oil or laxative enemata. Infusion of nutgalls might be of

use in poisoning by conia; and strychnia, as having an antagonistic tendency, might be tried as a restorative. Artificial respiration and other means are to be used as circumstances require.

Conia, the active principle of hemlock, is a most powerful poison, and may be compared in activity with hydrocyanic acid, atropia, and aconitia. "Its volatility, combined with its great activity," says Gubler, "reminds us of the subtilty of the famous poisons with which it was sufficient to impregnate a letter or a pair of gloves, in order to put out of the way a person who had become troublesome or disliked." A single drop placed in the eye of a rabbit caused death in nine minutes; three drops applied in the same manner to a cat caused death in a minute and a-half; five drops placed in the throat of a dog killed it in one minute. Pain is instantly felt in the part touched by conia, especially if it be a delicate structure, such as serous or mucous membranes, redness and increased vascularity speedily following, showing that, in the first place, it acts as a topical irritant. But the topical effects are soon set aside by its general action, which consists in causing a rapid palsy of the muscles, first implicating those of voluntary motion, then the muscles of respiration, and lastly the diaphragm, death being caused by asphyxia. The external senses are said to remain unimpaired until respiration is affected. Conia is not excreted as such, but is destroyed in its passage through the system. Conia and strychnia produce antagonistic effects; they both operate through the spinal cord, strychnia causing permanent spasm of the muscles, by irritating the nervous centre; conia causing muscular paralysis, by exhausting the nervous power. Hence it has been proposed to employ conia as an antidote in cases of poisoning by strychnia and other poisons of that class, in hydrophobia, in tetanus, &c.

The symptoms of poisoning by hemlock have been variously recorded. Coma, convulsions, delirium, and general paralysis have been described as results of over-doses. Professor Christison says: "The actions of hemlock have been long misunderstood. It has been known immemorially as a narcotic poison of great virulence; and it was supposed to excite convulsions and fatal coma, to render the blood fluid, and to exhaust the irritability of the heart. I have endeavoured, on the contrary, to show that it leaves the heart's action unimpaired, and does not prevent the blood from coagulating any more than other causes of death by asphyxia —that it does not excite convulsive spasms or bring on insensibility —but that it exhausts the nervous energy of the spinal cord and

voluntary muscles, occasioning merely convulsive tremors and slight twitches, and eventually general paralysis of the muscles and consequent stoppage of the breathing." According to Dr John Harley, the *first* effect of hemlock is a depression of the motor function, and its *last* the complete obliteration of all muscular movement derived from the cerebro-spinal motor tract; and it exerts its power *chiefly*, if not *exclusively*, upon the motor centres of the cord situated within the cranium. The earliest indications of its operation are those arising from depression of the third pair of nerves, such as giddiness, sense of a heavy weight depressing the eyelids, or even actual ptosis; a dull, expressionless stare, like that of a drunken person, and dilatation of the pupils. In full doses, other nerves get affected; the movements of the eyeball become lazy, double vision may come on — evidence of general diminution of the action of the nerves supplying the other muscles of the eye and face. Dr Harley has not observed any special action upon the motor branches of either the eighth or the ninth pair of cranial nerves. The reflex function, or motor activity of the *spinal cord*, is interfered with last of all, and only in the case of poisonous doses. As, however, in spasmodic disorders arising from irritable conditions of the vagus, and also in irritable conditions of the spinal cord, hemlock is found to act beneficially as a therapeutic agent, Dr Harley believes it must exert some special physiological effect upon those parts. It exerts no direct action upon the cerebrum proper. It is no true anodyne. It lessens muscular irritability, and, as it were, puts the whole motor functions of the individual to sleep, and may be said to be to the whole motor tract what opium is to the cerebrum. The effect of hemlock on an individual seems to be proportional, not to his muscular strength, but to his motor activity. An active, restless child is often able to take, without any appreciable result, what would be found to paralyse an indolent adult. People of sedentary habits are more readily affected by it than those accustomed to much bodily exertion. People accustomed to the use of tobacco are not readily brought under its influence.

Conium, as a medicine, is purely sedative and antispasmodic. It is no true anodyne nor hypnotic. It is of great benefit in many cases of undue nervous motor excitability. In order to produce beneficial results, hemlock must in all cases be given in doses sufficient to produce its physiological action. It is recommended by Dr J. Harley, in the undue excitement of the motor centres frequently accompanying the period of dentition in children; in epilepsy, pro-

vided the irritation is central and motor, and not peripheral or emotional, and especially if the disease is traceable to sexual abuse; in convulsive diseases of special muscles; in chorea; in paralysis agitans during its early stage; in nocturnal cramps; in cases of tetanus; in diseases due to spasmodic action of the vagus, such as spasm of the œsophagus, spasmodic contraction of the stomach and œsophagus, spasmodic cough, laryngismus stridulus, whooping-cough, spasmodic asthma; in organic or functional diseases of the cord attended with excessive irritability of reflex function, as in certain cases of paraplegia, of concussion of the spine, and from the practice of self-abuse in early life; in inflammatory diseases of the eye; and to retard the progress as well as lessen the pain of cancer. Doubtless much of the discredit that has been attached to the drug has arisen in consequence of the employment of preparations destitute of the active principle. Hence many writers have attributed wasting of the mammæ and testicles, and the removal of tumours, especially of the breast, to its use, effects which others have sought for in vain. Conium was also formerly highly esteemed as an alterative and deobstruent in scrofulous affections, in secondary syphilis, in visceral and glandular enlargements, and in certain varieties of cutaneous diseases. But more exact information in regard to the nature of its action, and the liability of its active principle to decompose or escape, prove beyond doubt that those effects were not real, but fanciful. For external purposes, the officinal cataplasm and an ointment are used. Since the dried plant is almost inert, however, it follows that very little benefit can be expected from the former.

Apiol is a heavy oily yellowish liquid, having a pungent taste and odour, obtained from the seeds of common parsley. It has been used as a substitute for quinine in intermittent fever, and also as an emenagogue. *Dose,* five to fifteen drops in mucilage or in capsules.

SUMBUL RADIX—Sumbul Root—Musk Root—The dried transverse sections of the root of a plant the botanical history of which is unknown. Imported from Russia, and also from India.

CHARACTERS.—*The pieces are nearly round, from* $2\frac{1}{2}$ *to* 5 *inches in diameter, and from* $\frac{3}{4}$ *to* $1\frac{1}{2}$ *inch in thickness. They are covered on the outer edge with a dusky brown rough bark, frequently beset with short, bristly fibres. The interior is porous, and consists of irregular, easily separated fibres. It has a strong odour, resembling that of musk. The taste is at first sweetish, becoming after a time bitterish and balsamic. That brought from India differs from the Russian, being closer in texture, more dense and firm, and of a reddish tint.*

Tinctura Sumbul—Tincture of Sumbul.

PREPARATION.—*Take of sumbul root, in coarse powder,* $2\frac{1}{2}$ *ounces; proof spirit,* 1 *pint. Macerate the sumbul for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Sumbul contains a volatile oil, two balsamic resins, wax, starch, &c.; also a crystallisable acid called sumbulic acid. It has been employed as a nervine stimulant, and appears to be allied to valerian in its action. It is also used for the sake of its antispasmodic and composing qualities. It has been given in hysteria, chorea, epilepsy, delirium tremens, low typhoid fevers, chronic pulmonary affections, cholera, &c.

Dose, of the powder, ten to twenty grains; of the tincture, ten to thirty minims; the resin is given in doses of one quarter of a grain to a grain; a decoction also is used.

Cotyledon umbilicus—common navelwort—an indigenous plant of the order Crassulaceæ, has been employed as a remedy in epilepsy.

2. *Monopetalæ or Gamopetalæ.*

CAPRIFOLIACEÆ—The Honeysuckle Order.—Shrubs or herbs inhabiting the northern parts of Europe, Asia, and America. The plants have astringent, emetic, and purgative properties. Officinal plant: *Sambucus Nigra.*

Sambuci Flores—Elder Flowers.—Officinal plant: *Sambucus nigra,* Linn.; *Pentandria Trigynia;* the Common Elder. Illustration, plate 76, *Woodv. Med. Bot.* Officinal part: The fresh flowers, from indigenous plants. Officinal preparation: *Aqua Sambuci.*

Botany.—Arborescent. *Stem,* shrubby, much and always oppositely though irregularly branched. *Leaves,* pinnate; leaflets, two pairs, with an odd one. *Flowers,* white or cream-coloured, in large terminal cymes. *Fruit,* a globular black, three to four-seeded berry. *Habitat,* indigenous.

CHARACTERS.—*Flowers small, white, fragrant, crowded in large cymes.*

AQUA SAMBUCI—ELDER-FLOWER WATER.—PREPARATION.—*Take of fresh elder flowers, separated from the stalks,* 10 *pounds, or an equivalent quantity of the flowers preserved while fresh with common salt; water,* 2 *gallons. Distil one gallon.*

Dose.—Of the water, one to two fluid ounces.

The elder is not much used in medicine; the flowers contain a volatile oil, and are somewhat stimulant and slightly diaphoretic; the berries are aperient and diuretic, and the liber or inner bark

of the tree is cathartic and emetic. Preparations of the bark have been given in dropsies and in epilepsy. The water is occasionally used as a flavouring vehicle for other remedies, but more commonly as a cosmetic.

CINCHONACEÆ—The Cinchona Order—Trees, shrubs, or herbs, chiefly inhabiting tropical regions. The order is extensive, and furnishes many important products; the plants possess tonic, stimulant, febrifugal, astringent, or emetic properties; some of the plants are said to produce intoxicating or poisonous effects; the fruits and seeds of some are edible. Officinal plants: *Cephaëlis Ipecacuanha, Cinchona calisaya, Cinchona Condaminea,* vars. *Chahuarguera,* Pavon, and *Crispa,* Tafalla, *Cinchona succirubra, Uncaria Gambir.*

Ipecacuanha—Ipecacuan.—Officinal plant: *Cephaëlis Ipecacuanha,* DC.; *Pentandria Monogynia;* the Ipecacuanha Plant. Illustration, plate 62, *Steph. and Church. Med. Bot.* Officinal part: The root dried; imported from Brazil. Officinal preparations: *Pilula Ipecacuanhæ cum Scilla, Pilula Conii Composita, Trochisci Ipecacuanhæ, Pulvis Ipecacuanhæ Compositus, Trochisci Morphiæ et Ipecacuanhæ, Vinum Ipecacuanhæ.*

Botany.—Root, perennial, about the thickness of a quill, four to six inches long, simple, flexuose, or with a few diverging branches, annulated. *Stem,* two or three feet long, somewhat shrubby, often rooting near the ground, ascending at length erect, and somewhat pubescent, towards the apex. *Leaves,* seldom more than four or six, placed at the end of the stem and branches, opposite, oblong, obovate, rough on the upper, finely pubescent on the lower surface. *Flowers,* collected into heads, each head being semi-globose, and eight to ten-flowered, white. *Flowering time,* November to March. *Fruit,* a berry about the size of a coffee-bean, fleshy, and violet-black. *Habitat,* shady places in the forests of Brazil.

CHARACTERS.—*In pieces three or four inches long, about the size of a small quill, contorted, and irregularly annulated. Colour, brown of various shades. It consists of two parts, the cortical or active portion, which is brittle, and a slender tough white woody centre. Powder, pale brown, with a faint nauseous odour, and a somewhat acrid and bitter taste.*

The roots are collected by the farmers and native Indians at all seasons, but chiefly from January to March inclusive, and are imported into this country from Rio Janeiro, Bahia, and Pernambuco, in bales, barrels, or bags. The root is met with in pieces three or four inches long, and about the size of a writing-quill; it is contorted, and either simple or branched. It is termed annulated, from the rings of the cortical part, which have a knotty annular appearance. The root is composed of two parts—an external cortical portion, greyish or brownish in colour, brittle, resinous, divided into rings of unequal size, being neither equal to each other nor individually of the same size at all parts; and an internal meditullium, composed of tough, yellowish-white, woody and vascular tissue, running longitudinally through the root, having

the appearance of a cord strung with rings or beads. The relative proportions of these parts are four of cortex, which is the active part, to one of meditullium. The root has an acrid, aromatic, bitter taste, a peculiar disagreeable odour, and a colour varying from greyish to reddish-brown. It is readily reduced to powder, which has a pale brownish-yellow colour. The principal ingredients of the root are an alkaloid, termed *Emetina* or *Emetia, Ipecacuanhic* or *Cephaëlic acid,* volatile oil, fatty matter, &c. *Emetina,* when quite pure, is white, pulverulent, and inodorous, and has a slightly bitter taste; it is soluble in warm water, and readily so in alcohol, but scarcely at all in ether or in oils. It has been proposed as a substitute for ipecacuan, being supposed to possess all the virtues of the officinal preparations. It acts, when pure, in very minute doses, as an emetic, and more or less as a soporific; one-sixteenth of a grain will cause vomiting in an adult man, and two grains have killed a dog.

Pilula Ipecacuanhæ cum Scilla—Pill of Ipecacuanha with Squill.

PREPARATION.—*Take of compound powder of ipecacuanha,* 3 *ounces; squill in powder; ammoniacum in powder, of each* 1 *ounce; treacle, a sufficiency. Mix the powders, and beat into a mass with the treacle.*

This pill combines the diaphoretic and sedative properties of the compound ipecacuanha powder with the expectorant qualities of the squills; hence it is particularly useful in chronic bronchitis, when the administration of opium alone, though desirable to allay the irritation, is apt to be injurious, by diminishing the pulmonary secretion.

PULVIS IPECACUANHÆ COMPOSITUS.—COMPOUND POWDER OF IPECACUANHA. *Synonyms:* Pulvis Ipecacuanhæ cum Opio, 1864—Dover's Powder. *Take of ipecacuanha, in powder,* ½ *ounce; opium, in powder,* ½ *ounce; sulphate of potash, in powder,* 4 *ounces. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.*

Trochisci Ipecacuanhæ—Lozenges of Ipecacuanha.

PREPARATION.—*Take of ipecacuanha, in powder,* 180 *grains; refined sugar, in powder,* 25 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water,* 1 *fluid ounce, or a sufficiency. Mix the powders, and add the mucilage and water to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot air chamber with a moderate heat. Each lozenge contains a quarter of a grain of ipecacuanha.*

A pleasant expectorant in cases of bronchitis, or when there is dryness or irritability of the throat.

VINUM IPECACUANHÆ—WINE OF IPECACUANHA.—*Take of ipecacuanha, bruised,* 1 *ounce; sherry,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation, strain, press, and filter; then add sufficient sherry to make one pint.*

Dose.—Of the powdered root as an emetic, from five to fifteen, twenty, or more grains for an adult, one grain for an infant, with a sufficieny of diluents, such as tepid water. One grain of tartarated antimony, with ten or twelve grains of powdered ipecacuan, are frequently given together as an emetic. Of the wine, as an emetic to children, twenty mimims to one fluid drachm ; to an adult, two to four fluid drachms, but it is not commonly used as an emetic for adults ; as a diaphoretic and expectorant to a child, five to ten minims ; to an adult, ten to thirty or forty minims. Of the powder of ipecacuan and opium, five to fifteen grains as a sudorific ; ten grains, which constitute the popular *Dover's Powder,* contain one grain each of opium and ipecacuan. Of the pill of ipecacuanha with squill, five to ten grains thrice-a-day. Of the lozenges, one to three occasionally.

Ipecacuan, in the form of powder, acts as a topical irritant when applied to a sensitive membrane, as is well seen in some persons in whom a violent attack of spasmodic asthma is occasioned by the inhalation of the finer particles. Besides this topical irritant property, ipecacuan acts as a nauseant, emetic, expectorant, diaphoretic, and sedative. When continued in small doses it acts upon the secreting membranes, especially the mucous membrane of the bronchi, facilitating expectoration. In larger doses it acts as a nauseating emetic, and imparts also a sense of weariness and a tendency to sleep. When circumstances favour it, it acts also as a diaphoretic. As an emetic, ipecacuan is a safe remedy, its effects being neither too depressing nor too long sustained. It is a safe remedy in infantile cases in which emetics are required, as in whooping-cough, in catarrh with difficult expectoration, croup, &c. ; and it is likewise useful for adults, especially those of debilitated constitution ; for this purpose it is given at the commencement of continued fevers, also to remove irritant matters from the stomach under various circumstances, and to remove deleterious substances in narcotic poisoning. It is given in chronic bronchitis, in chronic catarrh, and in nauseating doses in acute bronchial affections, in bronchial and other varieties of hemorrhage, in spasmodic asthma, in dyspepsia, dysentery, diarrhœa, &c. Dr Ringer, in his recent work on therapeutics, recommends ipecacuanha in drop doses, administered every hour, or three times a-day, in

1, The vomiting of pregnancy, when not accompanied and dependent upon acidity of the stomach ;

2, In the morning vomiting of drunkards ;

3, In morning vomiting resulting from general weakness, and met with in puerperal women, and in convalescents from acute diseases ;

4, In the vomiting of whooping-cough ;
5, When the food is rejected after meals in a partially digested condition, without either pain, nausea, or discomfort ;
6, To check vomiting resulting from cancer of the stomach.

It is difficult to understand how such minute doses could have the effect indicated by Dr Ringer. Dr Anstie suggests that if ipecacuanha is found to have such action, it is explainable on the theory that it possesses a nerve-tonic power in common with the other members of the cinchona family. The records, in the medical journals recently, of certain trials by various practitioners, seem to lean to the belief that ipecacuanha has to some extent the power to check vomiting ; but the cases are far too limited to warrant a positive conclusion. The editor has again and again attempted to verify Dr Ringer's assertions, but he has almost invariably been disappointed by the results. Ipecacuanha is of the greatest value in the cure of acute tropical dysentery, in the treatment of which it is often given in very large doses (25–30 grains), by the mouth, as well as injected into the large intestine by the long tube. This large dose is to be followed by a smaller dose in about eight hours, provided relief is not obtained. Nausea seldom is distressing. In chronic dysentery it is administered in doses of one to three grains thrice a-day, along with opium and mercury. Ipecacuanha was originally introduced into practice by Helvitius as a cure for dysentery, and hence was originally termed Radix Antidysenterica. The powder of ipecacuan and opium is a popular sudorific, and is employed in a variety of cases. Sometimes, given in small doses, it occasions vomiting, and it should not be given when there is much irritability of the stomach. Finely-powdered ipecacuan, made into a liniment with lard and olive oil, and rubbed into the skin, acts as a counter-irritant, producing a vesicular eruption, which, without causing much pain, disappears in the course of two or three days.

Cinchonæ Flavæ Cortex—Yellow Cinchona Bark.—Officinal plant : *Cinchona Calisaya*, Weddell, *Hist. Nat. des Quinquinas*, plates 2, 3, *bis.* and 28. Officinal part : The bark ; collected in Bolivia and Southern Peru. Officinal preparations : *Quiniæ Sulphas*, *Decoctum Cinchonæ Flavæ*, *Extractum Cinchonæ Flavæ Liquidum*, *Infusum Cinchonæ Flavæ*, *Tinctura Cinchonæ Flavæ*.

Cinchonæ Pallidæ Cortex—Pale Cinchona Bark.—Officinal plant: *Cinchona Condamenea*, DC., vars. *Chahuarguera*, Pavon, and *crispa*, Tafalla. Illustrations, plates 2 and 3, *Howard's Illustrations* (*Cinchona chahuarguera*, and *C. crispa*). Officinal part: The bark ; collected

about Loxa and Ecuador. Officinal preparation: *Tinctura Cinchonæ Composita.* Enters into preparation of *Mistura Ferri Aromatica.*

Cinchonæ Rubræ Cortex—Red Cinchona Bark.—Officinal plant: *Cinchona succirubra*, Pavon MS.; *Neuva Quinologia.* Illustration, plate 9, *Howard's Illustrations.* Officinal part: The bark; collected on the western slopes of Chimborazo.

Cinchona lancifolia, Mutis, is also officinal as one of the sources of sulphate of quinia.

Botany.—Cinchona Calisaya. A tall tree; *trunk*, straight or bent, naked, frequently twice the thickness of a man's body; the leafy head for the most part elevated above all the other forest trees. *Leaves*, oblong or lanceolate-obovate, obtuse, attenuated at the base, rarely acute on both sides, smooth, polished or pubescent beneath: pitted in the axils of the veins. *Filaments*, usually shorter than one-half the length of the anthers. *Capsule*, ovate, scarcely equal in length to the flower. *Seeds*, frequently fimbriate-denticulate at the margin. Of this species, Weddell has described two varieties, namely, *Calisaya Vera*, which yields the officinal yellow bark, and whose characters are here mentioned; and *Calisaya Josephiana*, a shrub of six to ten feet in height, with a slender branching trunk, erect branches, and leaves rather acute, oblong-lanceolate or ovate-lanceolate. *Habitat*, declivities and steep rugged places of the mountains, at an altitude of from five to six thousand feet, in the hottest forests of the valleys of Bolivia and Southern Peru; between 13° and 16° 30′ south latitude, and from 64° to 70° west longitude; in the Bolivian provinces near La Paz of Enquisivi, Yungas, Larecaja or Sorata, and Canpolican, or Apolobamba; and in the Peruvian province of Carabaya. It flowers in April and May.

Cinchona Condaminea, var. *Chahuarguera*, Pavon, a lofty tree; and var. *crispa*, Tafalla, a small tree or shrub. *Branches*, opposite, smooth. *Leaves*, lanceolate, ovate, roundish, usually acute, smooth and shining above, sometimes pitted in the axils of the veins beneath. *Capsule*, oblong-ovate, scarcely twice as long as broad. Weddell associates with these the *Cinchona lancifolia* of Mutis, the leaves of which are lanceolate or ovate-lanceolate, acute at both ends, without pits. *Habitat*, Loxa in Ecuador and adjacent Peru, at an elevation of from 5700 to 7700 feet above the level of the sea, specimens of *C. lancifolia* being met with as high as 10,000 feet, and the species Condaminea is now cultivated on the Neilgherries at an elevation of 8000 feet.

Cinchona succirubra—A middle-sized tree. *Trunk*, erect, with a branched head; when wounded, it exudes a milky juice, which becomes red on exposure, hence the name of the plant. *Leaves*, petiolate, large, broadly ovate, smooth, somewhat shining, deep green above, paler and pubescent beneath. *Flowers*, in dense terminal panicles. *Capsule*, oblong, slightly incurved. *Habitat*, forests at the foot of Chimborazo, cultivated at Ootacamund, on the Neilgherries.

There are about twenty recognised species of Cinchona altogether, but only those above mentioned are officinal; they belong to the Linnæan class and order *Pentandria Monogynia.*

Cinchona bark is usually peeled from the trees about the month of

May, but it may be taken at any period, except during the rainy season. The natives employed in collecting the bark, who have received the title of *Cascarilleros*, work under the supervision of a *major domo*, and either remove the bark from the tree as it stands, or, what is preferable, they first fell the tree at a short distance above the roots. The bark is then removed either in strips or by accurately incised pieces of from fifteen to twenty inches in length, and four to six inches in width, and is carefully brushed. The strong trunk bark is submitted to pressure, which leaves it in flattened pieces, whilst the thinner branch bark is simply exposed to the drying effects of the sun, whereby it is formed into rolls or quills. After it has undergone this process, the bark is picked, the bad being rejected, and the good sewed up in coarse canvas, which receives a supplementary covering of fresh hide when the packages reach the depots in the towns.

Cinchonæ Flavæ Cortex—Yellow, Royal Yellow, or Calisaya Bark.

CHARACTERS.—*In flat pieces, uncoated or deprived of the periderm, rarely in coated quills, from six to eighteen inches long, one to three inches wide, and two to four lines thick, compact and heavy; outer surface brown, marked by broad, shallow irregular longitudinal depressions; inner surface tawny-yellow, fibrous; transverse fracture shortly and finely fibrous. Powder cinnamon-brown, somewhat aromatic, persistently bitter.*

There are two varieties of yellow bark. The *quilled* variety, called also *Calisaya rolada*, which is comparatively rare, occurs in pieces of different sizes, from two or three to eighteen inches in length, from a quarter of an inch to two or three inches in diameter, and from two to four or six lines in thickness. Externally, it is brownish, longitudinally wrinkled, and transversely fissured, and occasionally the periderm is partially covered with yellowish or whitish lichens; internally, it is smooth, and cinnamon-coloured. The *flat* variety, also called *Calisaya plancha*, is obtained from the trunk or larger branches, in pieces of from eight to eighteen inches long, one to three or four inches broad, and one to five lines thick; it may be either quite flat, or somewhat curved; it is very fibrous, has no periderm, and is yellow, both externally and internally. The periderm, when attached, is generally readily separable, as may be also inferred from the smoothness of the flat pieces, showing that no violence had been used in its separation. Yellow bark has a short, splintery fracture, and the powder contains shining transparent spiculæ, which irritate the skin when applied to it, somewhat like the hairs of cowhage. Yellow bark contains a large proportion of quinia, and but little cinchonia. The hard Carthagena bark (*China flava dura*); the fibrous Carthagena bark (*China flava fibrosa*); the Cuzco bark (*China rubiginosa*), and several other varieties, belong to the class of Yellow Bark. The orange, spongy, or fibrous Carthagena bark, produced by *Cinchona lancifolia Mutis*, is mentioned in the Pharmacopœia as one of the sources of quinine. It is met with in quilled or in flat pieces of different sizes, and usually with an epiderm more or less covered with lichens. It is loose, spongy, and fibrous in texture, and of a yellowish or orange colour.

Cinchonæ Pallidæ Cortex—Pale, Crown, or Loxa Bark.

CHARACTERS.—*From half-a-line to a line thick, in single or double*

quills, which are from six to fifteen inches long, two to eight lines in diameter, brittle, easily splitting longitudinally, and breaking with a short transverse fracture; outer surface brown and wrinkled, or grey, and speckled with adherent lichens, with or without numerous transverse cracks; inner surface bright orange or cinnamon-brown; powder, pale brown, slightly bitter, very astringent.

Pale bark is met with in quills or strongly rolled tubes, from six to fifteen inches in length, two or three lines to one inch in diameter, and from half-a-line to two lines in thickness. It is covered with an entire epidermis of a light or dark-greyish colour, and is often covered with lichens. Externally, it is marked by longitudinal wrinkles and transverse fissures, which seem to divide the bark into rings; internally, the bark is smooth, and not unlike cinnamon in colour. The middle-sized pieces are most esteemed. The bark has a bitter astringent taste, and a somewhat peculiar odour. The Lima or Huanuco Bark, commonly called grey or silver bark, the Jean or Ash Bark, the Huamilies Bark, and others, belong also to the class of *Cinchona Pallida.*

Cinchonæ Rubræ Cortex.—Red-Cinchona Bark.

CHARACTERS—*In flat or incurved pieces, less frequently in quills, coated with the periderm, varying in length from a few inches to two feet, from one to three inches wide, and two to six lines thick, compact and heavy; outer surface brown or reddish-brown, rarely white from adherent lichens, rugged or wrinkled longitudinally, frequently warty, and crossed by deep transverse cracks; inner surface redder; fractured surface often approaching to brick-red; transverse fracture finely fibrous; powder red-brown; taste bitter and astringent.*

Red bark is usually met with in flat and slightly incurved pieces, from one inch to two feet in length, one to five inches in breadth, and from three to nine lines in thickness; but it also occurs, though more rarely, in quills. The periderm, which is of a greyish or reddish-brown colour, is usually attached, and is more or less variegated in colour by adhering lichens; it has frequently a rough, warty, and fissured external appearance. Internally, it is roughly fibrous in texture, and of a deeper colour than the other cinchona barks. It breaks with a fibrous splintered fracture, and in powder has a reddish-brown colour. This variety is not so common as the others, and yields more equally quinia and cinchonia.

TEST FOR THE PURITY OF CINCHONÆ FLAVÆ CORTEX—*Boil* 100 *grains of the bark, reduced to very fine powder, for a quarter of an hour, in a fluid ounce of distilled water acidulated with ten minims of hydrochloric acid, and allow it to macerate for twenty-four hours. Transfer the whole to a small percolator, and after the fluid has ceased to drop, add at intervals about an ounce and a-half of similarly acidulated water, or until the fluid which passes through is free from colour. Add to the percolated fluid solution of subacetate of lead, until the whole of the colouring matter has been removed, taking care that the fluid remains acid in reaction. Filter, and wash with a little distilled water. To the filtrate add about thirty-five grains of caustic potash, or as much as will cause the precipitate which is at first formed to be nearly redissolved, and afterwards six fluid drachms of pure ether. Then shake briskly, and, having removed the ether, repeat the*

process twice, with three fluid drachms of ether, or until a drop of the ether employed leaves, on evaporation, scarcely any perceptible residue. Lastly, evaporate the mixed ethereal solutions in a capsule. The residue, which consists of nearly pure quinia, when dry, should weigh not less than two grains, and should be readily soluble in diluted sulphuric acid.

TEST FOR THE PURITY OF CINCHONÆ PALLIDÆ CORTEX.—200 *grains of the bark, treated in the manner directed in the test for yellow cinchona bark, with the substitution of chloroform for ether, should yield not less than one grain of alkaloids.*

TEST FOR THE PURITY OF CINCHONÆ RUBRÆ CORTEX.—100 *grains of the bark, treated in the manner directed in the test for yellow cinchona bark, with the substitution of chloroform for ether, should yield not less than one and a-half grain of alkaloids.*

Cinchonometry is the name applied to a variety of processes employed for the purpose of ascertaining the relative value and purity of the different kinds, or of different samples of the same kind, of cinchona bark, by estimating the quantity of quinia, or the other alkaloids. It has been observed that the excellence of the cinchona barks is in direct proportion to the quantity of lime and tannic acid present, so that any specimen from which a large quantity either of lime or tannic acid can be obtained is considered to be good, and likely to yield a satisfactory amount of alkaloids. But it is a more accurate method of determining the absolute or relative value of the barks to ascertain directly the per-centage of alkaloids present in them, and for this purpose the Pharmacopœia has the above tests, the *rationale* of which is as follows. In testing the yellow bark, the quinia alone is estimated; whereas in testing the other two, all the alkaloids are taken together; therefore, yellow bark should contain an amount of quinia one-third more than equal to all the alkaloids of the red bark, and equal to four times the quantity of all the alkaloids of the pale bark; or, in other words, yellow bark should yield not less than two per cent. of quinia, red bark not less than one and a-half per cent. of alkaloids, and pale bark not less than one-half per cent. of alkaloids. When the finely-powdered bark is submitted to the action of water acidulated with hydrochloric acid, first by boiling, and then by percolation, it gives up all its alkaloids, which are accompanied by colouring matter. The solution of subacetate of lead combines with the colouring matter, forming with it an insoluble substance, which is removed by the filtration. Next, on the addition of the solution of caustic potash, the hydrochloric acid is abstracted by it from the alkaloids, which are, in consequence, at first precipitated, but are nearly redissolved by an excess of the potash. Lastly, the ether, as directed to be used in the case of the yellow bark, will remove the quinia, leaving the other alkaloids behind; whilst the chloroform, as directed to be used in testing the red and pale barks, will remove all the alkaloids.

The following are the more important constituents of the cinchona barks.

Quinia or *Quinine*, an alkaloid, $C_{20}H_{24}N_2O_2$, exists in largest quantity in the yellow barks, to a much less extent in the red barks, but scarcely at all, or in very small quantity, in the pale barks. In the

barks, it is in combination with kinic acid, and the astringent principle termed cincho-tannic acid. Quinia is a hydrate, and yields water on the application of heat; it is usually obtained as a white porous mass, or as a white crystalline powder, but by very careful manipulation it may be obtained in the form of fine silky acicular crystals. It is inodorous, has an intensely bitter taste, and an alkaline reaction. It fuses at about 300°, forming a mass which, when cold, is yellow, translucent, and friable, and of resinoid appearance. It is almost insoluble in water, requiring four hundred parts of cold, and two hundred or more of boiling water; it is soluble in sixty parts of ether, in two of alcohol or chloroform, in twenty-four of olive oil, also in solutions of the alkalies, carbonate of ammonia, chloride of calcium, &c. Solutions of quinia and its salts exhibit a blue fluorescence, and when to either of them is first added fresh chlorine water, and then ammonia, a splendid emerald-green colour is produced. Quinia possesses the property of left-handed rotatory polarisation.

Quiniæ Sulphas—Sulphate of Quinia.—($C_{40}H_{24}N_2O_4,HO,SO_3 + 7HO$, or $(C_{20}H_{24}N_2O_2)_2H_2SO_47H_2O$), the sulphate of an alkaloid, prepared from yellow cinchona bark, and from the bark of *Cinchona lancifolia*, Mutis.

PREPARATION.—*Take of yellow cinchona bark, in coarse powder*, 1 *pound; hydrochloric acid*, 3 *fluid ounces; distilled water, a sufficiency; solution of soda*, 4 *pints; diluted sulphuric acid, a sufficiency. Dilute the hydrochloric acid with ten pints of the water. Place the cinchona bark in a porcelain basin, and add to it as much of the diluted hydrochloric acid as will render it thoroughly moist. After maceration, with occasional stirring for twenty-four hours, place the bark in a displacement apparatus, and percolate with the diluted hydrochloric acid until the solution which drops through is nearly destitute of bitter taste. Into this liquid pour the solution of soda, agitate well, let the precipitate completely subside, decant the supernatant fluid, collect the precipitate on a filter, and wash it with cold distilled water until the washings cease to have colour. Transfer the precipitate to a porcelain dish containing a pint of distilled water, and applying to this the heat of a water-bath, gradually add diluted sulphuric acid until very nearly the whole of the precipitate has been dissolved, and a neutral liquid has been obtained. Filter the solution, while hot, through paper, wash the filter with boiling distilled water, concentrate till a film forms on the surface of the solution, and set it aside to crystallise. The crystals should be dried on filtering paper without the application of heat.*

Rationale.—The alkaloids are removed by the hydrochloric acid in the form of hydrochlorates, which are decomposed by the solution of soda, chloride of sodium remaining in solution, along with colouring matter, &c., whilst the alkaloids are precipitated. By washing the collected precipitate with cold distilled water, adhering saline and colouring matters are removed. The alkaloids are next dissolved by the addition of sulphuric acid; the solution is purified by further filtration, and, lastly, it is concentrated till a film forms, and is then set aside to crystallise, when the sulphate of quinia, being less soluble, is crystallised out from the rest of the alkaloids, which are left behind in the mother-liquor.

CHARACTERS.—*Filiform, silky, snow-white crystals, of a pure, intensely bitter taste, sparingly soluble in water, yet imparting to it a peculiarly bluish tint. The solution gives with chloride of barium a white precipitate, insoluble in nitric acid,*[1] *and when treated first with solution of chlorine, and afterwards with ammonia, it becomes of a splendid emerald-green colour.*[2]

[1]Characteristic of a sulphate. [2]Characteristic of quinia. Sulphate of quinia is met with as a white, light, flocculent substance, consisting of fibrous, silky, flexible, acicular crystals, gathered into radiating tufts. It effloresces slightly when exposed to the atmosphere, is inodorous, but has an intensely bitter taste. When heated and rubbed it becomes luminous or phosphorescent. At 212° it loses seven atoms of water, melts like wax at 240°, and at a higher temperature the crystals assume a fine red colour. It is soluble only in a large quantity of water, but becomes readily soluble on the addition of sulphuric acid, and imparts to the surface of the water a peculiar blue tinge.

PURITY TESTS.—*Dissolves in pure sulphuric acid with a feeble yellowish tint, and undergoes no further change of colour when gently warmed.*[1] *Ten grains, with ten minims of diluted sulphuric acid and half-a-fluid ounce of water, form a perfect solution, from which ammonia throws down a white precipitate.*[2] *This re-dissolves on agitating the whole with half-a-fluid ounce of ether, without the production of any crystalline matter floating on the lower of the two strata, into which the agitated fluid separates on rest*[3] 25 *grains of the salt should lose* 3·6 *grains of water by drying at* 212°.

[1]Absence of salicin, which would give a bright red colour. [2]Hydrated quinia. [3]Absence of cinchonia and quinidia, which would remain in the lower or aqueous stratum; whilst the ether, with the quinia dissolved in it, would rise to form the upper stratum. The high price of sulphate of quinia renders it liable to adulteration. The following impurities have been detected in it:—The sulphates of cinchonia, quinidia, and lime, stearic and other fatty acids, salicin, phloridzin, salts of ammonia and of soda, gum, starch, sugar, sugar of milk, mannite, &c. The pharmacopœial tests are a sufficient guarantee of its purity.

TINCTURA QUINIÆ—TINCTURE OF QUINIA.—*Take of sulphate of quinia,* 160 *grains; tincture of orange peel,* 1 *pint. Dissolve the sulphate of quinia in the tincture with the aid of a gentle heat; then allow the solution to remain for three days in a closed vessel, shaking it occasionally, and afterwards filter.*

PILULA QUINIÆ—PILL OF QUINIA.—*Take of sulphate of quinia,* 60 *grains; confection of hips,* 20 *grains. Mix them to a uniform mass.*

VINUM QUINIÆ—WINE OF QUINIA.—*Synonym:* QUININE WINE. —*Take of sulphate of quinia,* 20 *grains; citric acid,* 30 *grains; orange wine,* 1 *pint. Dissolve, first the citric acid, and then the sulphate of quinia, in the wine; allow the solution to remain for three days in a closed vessel, shaking it occasionally; and afterwards filter.*

Quinine is used in the preparation of the citrate of quinine and iron, and several other salts and preparations of it are occasionally employed in medicine, such as the muriate and valerianate, which were formerly

in the Dublin Pharmacopœia, the acetate, tartrate, citrate, nitrate, arseniate, tannate, gallate, phosphate, &c., of which it must suffice to mention the names, their medicinal properties being supposed to be more or less equal to the sum of those of their constituents.

Amorphous Quinia and *Quinoidine.*—Amorphous Quinia is the name given to a substance which is found in the mother-liquor after the preparation of sulphate of quinia. By the addition of an alkaline carbonate to the mother-liquor, a light-brownish precipitate is produced, which, when washed and carefully dried by a gentle heat, assumes a resinous appearance. It is uncrystallisable, and is generally found in the substance called *quinoidine,* a name which was first applied by Sertuërner to amorphous quinia itself; but Van Heijningen has resolved quinoidine into ordinary quinia, cinchonia, quinidia, and a resinous substance; and Liebig also has ascertained that the so-called quinoidine is a compound of amorphous quinia with various inert substances. Amorphous quinia resembles ordinary quinia in most of its properties, differing from it chiefly in being uncrystallisable.

Cinchonia.—An alkaloid, $C_{20}H_{24}N_2O$, may be obtained probably from all the true cinchona barks. It crystallises in four-sided prisms, which are anhydrous, colourless, inodorous, and of somewhat bitter taste. It resembles quinia in many of its characters, but may be distinguished from it by being insoluble in ether, by which the two may be therefore readily separated, by possessing right-handed polarisation, and giving a white precipitate on the addition, first, of fresh chlorine water, and then ammonia, whereas quinia gives a rich emerald-green colour. The sulphate and hydrochlorate of cinchonia are occasionally employed medicinally.

Quinidia, an alkaloid isomeric with quinia, $C_{20}H_{24}N_2O_2$, is met with in most of the true cinchona barks. It crystallises in hard anhydrous, colourless prisms, which are inodorous, but have a bitter taste. In many of its characters it resembles quinia, but is much less soluble in water and in ether, though its sulphate is more soluble in water than the sulphate of quinia, and it possesses right-handed polarisation. With the chlorine water and ammonia test it gives an emerald-green colour, and its solutions exhibit a blue fluorescence; it may be recognised by a solution of the sulphate giving a precipitate with solution of iodide of potassium.

Cinchonidia, an alkaloid isomeric with cinchonia, $C_{20}H_{24}N_2O$, possesses left-handed polarisation, but does not give the emerald-green colour with the chlorine and ammonia test.

Aricina or *Cusconia* is, by some chemists, regarded as a distinct alkaloid, for which the formula $C_{20}H_{24}N_2O_3$ has been given; but it is also, by some, considered to be merely an impure cinchonia.

Quinicia and *Cinchonicia* are modifications of quinia and cinchonia produced by chemical changes, and do not exist as distinct ingredients of the cinchona barks.

Quinoleine, a volatile oily base, may be obtained from any of the cinchona alkaloids by distillation with caustic potash. It combines with acids, but has no alkaline reaction.

Kinic Acid, $C_{14}H_{20}O_{10}H_2O$, crystallises in oblique rhombic prisms, resembling tartaric acid in appearance. It is soluble in water, somewhat in alcohol, but sparingly in ether. It exists in the barks probably in combination with the alkaloids.

Cincho-tannic Acid differs from ordinary tannic acid chiefly in the following points :—In its formula, which is said to be $C_{14}H_{16}O_9$, or $C_{14}H_{12}O_7 2H_2O$, in precipitating the persalts of iron *green*, in the somewhat greater solubility of its salts, and in the property which it possesses of absorbing oxygen, whereby it is converted into an insoluble red substance, which is known as

Cincho-fulvic Acid, Red Cinchonic, or *Cinchona Red.*—This substance, as its name implies, is of a red colour. It is almost insoluble in water, but is somewhat soluble in alcohol and in ether. It is readily soluble in alkalies, giving the solution a deep-red colour, and is the colouring principle of most of the cinchona barks. It is believed to be produced by the oxidation of cincho-tannic acid.

Kinovic Acid somewhat resembles stearic acid. It is insoluble in water, but is soluble in alcohol and in ether. It occurs in many of the cinchona barks, and may be recognised by its solutions giving a green precipitate with copper, and by solutions of its alkaline salts giving precipitates with acetate of lead and chloride of mercury.

Besides the foregoing, the cinchona barks contain other constituents of minor importance.

DECOCTUM CINCHONÆ FLAVÆ—Decoction of Yellow Cinchona.—*Take of yellow cinchona bark, in coarse powder,* 1¼ *ounce; distilled water,* 1 *pint. Boil for ten minutes in a covered vessel. Strain the decoction, when cold, and pour as much distilled water over the contents of the strainer as will make the strained product measure one pint.*

EXTRACTUM CINCHONÆ FLAVÆ LIQUIDUM—Liquid Extract of Yellow Cinchona.—*Take of yellow cinchona bark, in coarse powder,* 1 *pound; distilled water, a sufficiency; rectified spirit,* 1 *fluid ounce. Macerate the cinchona bark, in two pints of the water, for twenty-four hours, stirring frequently; then pack in a percolator, and add more water, until twelve pints have been collected, or until the water ceases to dissolve anything more. Evaporate the liquor at a temperature not exceeding* 160° *to a pint; then filter through paper, and continue the evaporation to three fluid ounces, or until the specific gravity of the liquid is* 1·200. *When cold, add the spirit gradually, constantly stirring. The specific gravity should be about* 1·100.

INFUSUM CINCHONÆ FLAVÆ—Infusion of Yellow Cinchona.—*Take of yellow cinchona bark, in coarse powder,* ½ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for two hours, and strain.*

TINCTURA CINCHONÆ FLAVÆ—Tincture of Yellow Cinchona.—*Take of yellow cinchona bark, in moderately fine powder,* 4 *ounces; proof spirit,* 1 *pint. Macerate the cinchona bark for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

TINCTURA CINCHONÆ COMPOSITA—Compound Tincture of Cinchona.—*Take of pale cinchona bark, in moderately fine powder,* 2

ounces; bitter-orange peel, cut small, and bruised, 1 *ounce; serpentary root, bruised,* ½ *ounce; saffron,* 60 *grains; cochineal, in powder,* 30 *grains; proof spirit,* 1 *pint. Macerate the cinchona bark, and the other solid ingredients, for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—1. *Powdered Cinchona bark,* ten to thirty or forty grains as a tonic; from sixty to one hundred and twenty grains as an antiperiodic. It is seldom used, in consequence of its bulk and the nausea and vomiting which it frequently causes when given in large doses. It may be given in port wine.

2. *Decoction of Yellow Cinchona,* half a fluid ounce to two fluid ounces.

3. *Liquid Extract of Yellow Cinchona,* ten to thirty minims. Four fluid ounces represent one pound of bark. It is commonly used as a ready method of preparing the infusion, one fluid drachm of the extract being equal to eight fluid ounces of the infusion.

4. *Infusion of Yellow Cinchona,* one to two fluid ounces.

5. *Tincture of Yellow Cinchona,* half a fluid drachm to two fluid drachms.

6. *Compound Tincture of Cinchona* (Huxham's Tincture of Bark), one to three fluid drachms.

7. *Sulphate of Quinia,* one to three grains as a tonic; three to ten, twenty, or even more, as an antiperiodic. It may be given in pill, in mixture (dissolved by the addition of a little sulphuric acid), or in confection. As an antiperiodic, quinine may be given either in divided doses during the intermission, or in one full dose in anticipation of the paroxysm. The stomach and bowels should be prepared for its reception (or for the preparations of bark) by an emetic or purgative; and if the stomach should steadfastly resist the dose, it may be administered as an enema or endermically.

8. *Tincture of Quinia,* one, two, or more, fluid drachms. *Wine of Quinia,* one-half to one fluid ounce. *Pill of Quinia,* one to five grains, according to circumstances. Quinia, cinchonia, amorphous quinia, quinidia, and cinchonidia, though seldom prescribed, may be given in doses of from two to five grains; their salts, also, may be given in similar doses.

The chief difference between the action of cinchona and its alkaloids lies in the astringency of the former, which is due to the presence of cincho-tannic and cincho-fulvic acids; but beyond this, there are cases in the treatment of which, from causes not yet explained, the preparations of bark are found to be successful, when sulphate of quinia and other salts of the alkaloids have failed to afford any relief. The preparations of the various cinchona barks act as tonics, astringents, antiperiodics, and antiseptics. When given in large doses, they are apt to produce severe local irritation in the stomach and bowels, giving rise to nausea, or even vomiting

and purging, if the mucous membrane of the alimentary canal be previously in an irritable condition ; they tend also, by their astringency, to cause constipation. As tonics, these preparations are given in small doses, and are extensively employed in cases of debility, especially when this condition is produced or attended by profuse discharges, such a colliquative sweating or diarrhœa, which, by their astringency, they are frequently capable of arresting, or by other mucous or purulent discharges, such as leucorrhœa, abscesses, &c. They are useful in all cases of physical exhaustion, whether produced by chronic disease or as met with in convalescence from acute attacks, provided there be not febrile, inflammatory, or active hemorrhagic symptoms, and no great irritability of the stomach or bowels. As antiperiodics, the cinchona preparations are much less frequently employed than the alkaloids, in consequence of the bulk in which they must be given, and the disagreeable topical irritant effects which they produce ; for this purpose quinine, as a rule, possesses all the qualifications, with none of the disadvantages, of the barks ; but occasional cases are met with in which the bark alone can produce the desired effect. As a topical astringent and antiseptic, powdered bark may be sprinkled upon unhealthy discharging ulcers, and other external conditions of a similar kind. As a gargle, the infusion or decoction, with a mineral acid, may be employed with advantage in putrid sore throat.

Quinia and its preparations act also as tonics and antiperiodics, but have not the astringent properties of the barks. Sulphate of quinia, or quinine, is more extensively employed than any other of the preparations of cinchona, as a tonic, antiperiodic, and febrifuge, and, excepting astringency and aromatic flavour, it possesses all the valuable properties of the barks themselves, with the additional great advantage of being equally potent in doses which do not produce, to the same extent, the topical irritation of the stomach and bowels already adverted to. When given in large doses, or in moderate doses long continued, quinine, and also the preparations of the barks, may give rise to symptoms to which the name cinchonism, or quininism, has been applied. The more prominent of these symptoms are dulness of hearing ; singing, hissing, or buzzing in the ears ; fulness, tension, and pain in the head ; flashes of light across the eyes, nausea ; and at this stage the pulse may be either increased or diminished. If the dose be larger, or repeated, the cerebral symptoms are more completely developed ; there is vertigo, a staggering gait, the difficulty of hearing is increased ; there may

be perverted vision or total blindness, the face flushed, the fulness in the head may be relieved by epistaxis, and delirium and coma may ensue in extreme cases. When the early excitement has passed off, the sedative effects are observed in the reduced circulation, in the nervous depression, sighing, yawning, irresistible drowsiness, depression of spirits, muscular tremors, &c. When symptoms such as these are manifested, the patient must be guarded against the inflammatory affection of the brain or its membranes which may ensue in the first stage, and against the prostration which may follow at a later period. There is also a danger of the deafness or blindness remaining permanently. Quinine and the cinchona preparations are contra-indicated in certain cerebral affections, in inflammatory conditions of the alimentary canal, &c. Some hold that the symptoms known by the term *quininism* indicate a congested condition of the nerve centres; but there is reason to believe that quinine acts rather by stimulating the inhibitory action of the sympathetic, and that it consequently tends to produce a condition of anæmia of the brain and cord, to which state the symptoms of quininism are more correctly referred. It is thus that we can explain the fact that quinine is found frequently to possess a hypnotic action, provided there is present a condition bordering on cerebral hyperæmia, which condition naturally contra-indicates the employment of opium.

It is in the simple and uncomplicated forms of intermittent fevers that quinine and the cinchona preparations are most serviceable; and it is only after visceral disease, or other complications, when present, have been suitably treated by other remedies, that these remedies can be safely or profitably applied. In remittent fevers they are less efficacious. In other *regularly-recurring* disorders, such as neuralgia, tic douloureux, headache, and many others, the cinchonas and quinine are useful; but in diseases which attack the patient at uncertain intervals, such as epilepsy, &c., they are rarely of service. Quinine or the barks are not much employed in continued fever, but in cases of a low typhoid exhausting character, in which there are no contra-indicating circumstances, they may be given, especially if there be the least appearance of periodical exacerbations. In malignant scarlatina, small-pox, or erysipelas, in typhoid pneumonia, in dysentery, in hectic, in gangrene, in carbuncle, and many other rapidly-exhausting diseases, these preparations are indicated. In certain cachectic conditions, as in secondary syphilis, in scrofula, &c., in conjunction with other remedies, quinine or the

barks are often of essential service. In enlargement of the spleen, in tetanus, and many other disorders, these remedies are employed.

Cinchonia and its salts, and quinidia and its salts, possess medicinal properties similar to those of quinia and its salts, and may be employed in the same circumstances. Cinchonia salts are usually considered to be only about two-thirds as efficacious as those of quinia, so that, for the same effect, they require to be administered in proportionately larger doses. Cinchonidine probably possesses properties similar to those of cinchonia. Amorphous quinia, it has been stated, possesses properties more nearly allied to those of the preparations of the barks than any of the other alkaloids or their salts.

Catechu Pallidum—Pale Catechu.—Officinal plant: *Uncaria Gambir, Roxburgh, Flor. Ind.*—Illustration, plate 22, vol ix. *Trans. Linn. Soc.* (*Nauclea Gambir*). Officinal part: An extract of the leaves and young shoots; prepared at Singapore and in the Eastern Archipelago. Officinal preparations: *Infusum Catechu, Pulvis Catechu Compositus, Tinctura Catechu, Trochisci Catechu.*

Botany.—Uncaria Gambir is a stout, climbing shrub, with round branches and ovate-lanceolate acute leaves, with short petioles, smooth on both sides. *Stipules* ovate. *Flowers,* green and pink, on axillary solitary peduncles. *Calyx,* short, five-cleft. *Corolla,* funnel-shaped, tube slender; throat naked; lobes five, spreading. *Fruit,* a stalked two-celled capsule, with numerous imbricated winged seeds. An inhabitant of the islands of the East Indian Archipelago.

Purity Tests.—*Entirely soluble in boiling water. The decoction, when cool, is not rendered blue by iodine.*

Pale Catechu, called also Gambir Catechu, and known amongst dealers as *Terra Japonica,* is prepared as an extract from the leaves and young shoots of *Uncaria Gambir*, by first boiling them in water, then evaporating the decoction to the consistence of an extract, which is cut into squares and dried in the sun. The purity tests of the Pharmacopœia are intended to detect insoluble and amylaceous adulterations. There are several other varieties of catechu met with in commerce, which are chiefly used for tanning, and are all more or less impure. Good catechu is to a large extent soluble in boiling water, forming a reddish-brown infusion, which has a strong astringent taste, slightly reddens litmus paper, and gives a greenish-black precipitate with persalts of iron. Catechu consists chiefly of tannic acid, catechine or catechuic acid, mucilage, and insoluble matter. Catechine or catechuic acid may be obtained as a white, light powder, constituted of silky acicular crystals. The purity of catechu can only be ascertained by estimating the quantity of tannic and catechuic acids present.

INFUSUM CATECHU—Infusion of Catechu.—*Take of pale catechu, in coarse powder,* 160 *grains; cinnamon bark, bruised,* 30 *grains; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for half-an-hour, and strain.*

PULVIS CATECHU COMPOSITUS—Compound Powder of Catechu.—*Take of pale catechu, in powder* 4 *ounces; kino, in powder, rhatany root, in powder, of each* 2 *ounces; cinnamon bark, in powder, nutmeg, in powder, of each* 1 *ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.*

TINCTURA CATECHU—Tincture of Catechu.—*Take of pale catechu, in coarse powder,* $2\frac{1}{2}$ *ounces; cinnamon bark, bruised,* 1 *ounce; proof spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient proof spirit to make one pint.*

TROCHISCI CATECHU—Catechu Lozenges.—*Take of pale catechu, in powder,* 720 *grains; refined sugar, in powder,* 25 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water, a sufficiency. Mix the catechu, sugar, and gum, and add the mucilage and water to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains one grain of catechu.*

Dose.—Of powdered catechu, ten to sixty grains, allowed to dissolve in the mouth, or made into a bolus, or in a mixture with sugar and gum; of the infusion, one to two fluid ounces, as a vehicle for other astringent remedies, or as an astringent enema; of the compound powder, twenty to sixty or more grains; of the tincture, one-half to two fluid drachms, added to an astringent mixture; of the lozenges, one occasionally, slowly dissolved in the mouth.

Catechu, when pure, acts as a more powerful astringent than kino. It is used as an astringent in chronic non-inflammatory diarrhœa and dysentery, in combination with chalk and opiates. As a stomachic it is sometimes found to be serviceable in dyspepsia when chewed before meals. In passive uterine hemorrhages, and in mucous discharges from any of the mucous membranes, catechu is usefully employed. It is chewed or taken in the form of the lozenge as an application to relaxed throats, to obviate hoarseness in public speakers and singers, and in ulcers of the mouth. As a topical astringent it is applied to external ulcers in the form of ointment.

COFFEA ARABICA—The Coffee Plant—is a native of Arabia Felix and the borders of Abyssinia, but is extensively cultivated in many countries. Its fruit is succulent, and of a reddish-brown colour when ripe; it contains two seeds, which are enclosed in an endocarp called the parchment of coffee. The seeds, when roasted, are used in the preparation of the esteemed beverage *coffee;* they contain, in addition to other constituents, a principle termed *caffeine,* which is identical with theine, and an aromatic volatile oil. The leaves of the tree, to a certain extent, possess the properties of the seeds, and are used in Sumatra, and elsewhere, in the preparation of an infusion which is taken as a substitute for tea under the name of *Coffee-Tea.* The more esteemed

varieties of coffee are Mocha, Ceylon (plantation), Costa Rica, Madras, Mysore, Brazil, &c. Coffee is greatly subjected to adulteration, especially when it is sold in the form of *ground coffee.* The substance most commonly mixed with it is the roasted root of *Cichorium intybus,* the chicory plant, or wild endive, commonly called Chicory, which is itself extensively adulterated. Coffee acts as a stimulant, arousing the nervous energy and increasing the action of the heart. It is extensively used as a breakfast beverage, and is employed medicinally to counteract the effects of narcotic poisons.

VALERIANACEÆ—The Valerian Order.—Herbs, inhabiting the temperate climates of Europe, Asia, and America. The plants possess stimulant, antispasmodic, and tonic properties, due to the presence of a strong-scented volatile oil. Officinal plant: *Valeriana officinalis.*

Valerianæ Radix—Valerian.—Officinal plant: *Valeriana officinalis,* Linn.; Common Valerian (wild or cultivated); *Triandria Monogynia.* Illustration, plate 96, *Woodv. Med. Bot.* Officinal part: The root of plants indigenous to and also cultivated in Britain, collected in autumn and dried; that from wild plants growing on dry soil being preferred. Officinal preparations: *Infusum Valerianæ, Tinctura Valerianæ, Tinctura Valerianæ Ammoniata.*

Botany.—Herbaceous. *Root-stock,* perennial, tuberous, with numerous root-fibres from two to six inches long. *Stem,* solitary, two to four feet high, furrowed, smooth. *Leaves,* all pinnate; leaflets, seven to ten pairs, lanceolate-dentate, terminal leaflet little, if at all, larger than the others. *Inflorescence,* a corymb, becoming somewhat panicled. *Flowers,* whitish or flesh-coloured. *Fruit,* smooth, compressed, one-celled, and one-seeded. *Habitat,* indigenous, commonly growing in ditches and damp places, but occasionally in dry and elevated situations.

CHARACTERS.—*A short yellowish-white rhizome, with numerous fibrous roots about two or three inches long; of a bitter taste and penetrating odour, agreeable in the recent root, becoming fetid by keeping; yielding volatile oil and valerianic acid when distilled with water.*

The root-stock of plants growing wild in dry pastures is more fragrant than that of cultivated plants. The *volatile oil* is of greenish colour, and consists of a crystallisable oily principle, termed *valerole,* and a hydrocarbon, resembling the oil of Borneo camphor, termed *bornéene. Valerianic acid* is an oily fluid, of specific gravity 0·9, has a strong odour of valerian, and forms salts with bases. This acid may be prepared by the oxidation of Fousel oil, the hydrated oxide of amyle. (See the process for the preparation of Valerianate of Soda, p. 200.)

INFUSUM VALERIANÆ—INFUSION OF VALERIAN.—*Take of valerian, bruised,* 120 *grains; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain.*

TINCTURA VALERIANÆ—TINCTURE OF VALERIAN.—*Take of valerian root, in coarse powder,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the valerian root for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when*

the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

TINCTURA VALERIANÆ AMMONIATA—AMMONIATED TINCTURE OF VALERIAN.—*Take of valerian root, in coarse powder, 2½ ounces; aromatic spirit of ammonia, 1 pint. Macerate for seven days in a well-closed vessel, with occasional agitation; then strain, press, filter, and add sufficient aromatic spirit of ammonia to make one pint.*

Dose.—Of the infusion, one or two fluid ounces; of the tincture, half a fluid drachm to two fluid drachms; of the ammoniated tincture, one-half to one fluid drachm; of the powdered root, twenty to sixty grains; of the oil of valerian, two to five drops.

Valerian acts as a stimulating antispasmodic, acting upon the brain in large doses, causing vertigo, headache, loss of vision, &c. It is useful in purely nervous cases, especially when these are complicated with hysteria. It has been recommended in typhoid fever, in typhoid pneumonia, in hysteria, in neuralgia, in insanity, in epilepsy, &c.

COMPOSITÆ or ASTERACEÆ—The Composite Order.—Herbs or shrubs universally distributed. This order was subdivided by Jussieu into three sub-orders—1. *Cichoraceæ,* Chicory or Lettuce Section. 2. *Cynarocephalæ,* Artichoke or Thistle Section. 3. *Corymbiferæ,* Chamomile Section. The properties of the composite plants are various, most of them being more or less bitter; they may be stimulant, carminative, tonic, narcotic, laxative, anthelmintic, &c. Officinal plants: An undetermined species of *Artemisia, Anthemis nobilis, Taraxacum Dens Leonis, Arnica montana, Anacyclus Pyrethrum, Lactuca Virosa.*

Santonica—Santonica.—Officinal plant: An undetermined species of *Artemisia,* Linn. Officinal part: The unexpanded flower-heads; imported from Russia.

Santonica, known also as *Semen sanctum, Semen santonica, Semen contra, Semen cynæ, Artemisia santonica,* wormseed, &c., has long been employed as a vermifuge. Two varieties are recognised in commerce—one, Aleppo, Alexandrian or Levant, wormseed, referred by Guibourt to *Artemisia contra;* the other, Barbary wormseed, referred to *Artemisia glomerata.*

CHARACTERS.—*Flower-heads rather more than a line in length, and nearly half-a-line in breadth, fusiform, blunt at each end, pale greenish-brown, smooth; resembling seeds in appearance, but consisting of imbricated involucral scales, with a green midrib, enclosing four or five tubular flowers; odour strong, taste bitter, camphoraceous.*

PURITY TEST.—*Flower-heads not round or hairy.*

The test indicates the absence of the flowers of other species of Artemisia, such as *A. vulgaris* or *A. absinthium.* The flowers contain a volatile oil, and a peculiar neutral principle termed *Santonin.*

Santoninum—Santonin.—($C_{30}H_{18}O_6$, or $C_{15}H_{18}O_3$.) A crystalline neutral principle, obtained from Santonica.

PREPARATION.—*Take of santonica bruised,* 1 *pound; slaked lime,* 7 *ounces; hydrochloric acid, a sufficiency; solution of ammonia,* ½ *fluid ounce; rectified spirit,* 14 *fluid ounces; purified animal charcoal,* 60 *grains; distilled water, a sufficiency. Boil the santonica with a gallon of the water and five ounces of the lime, in a copper or tinned iron vessel, for an hour, strain through a stout cloth, and express strongly. Mix the residue with half-a-gallon of the water and the rest of the lime, boil for half-an-hour, strain, and express as before. Mix the strained liquors, let them settle, decant the fluid from the deposit, and evaporate to the bulk of two pints and a-half. To the liquor while hot add, with diligent stirring, the hydrochloric acid, until the fluid has become slightly and permanently acid, and set it aside for five days, that the precipitate may subside. Remove by skimming any oily matter which floats on the surface, and carefully decant the greater part of the fluid from the precipitate. Collect this on a paper filter, wash it first with cold distilled water till the washings pass colourless and nearly free from acid reaction, then with the solution of ammonia previously diluted with five fluid ounces of the water and lastly, with cold distilled water, till the washings pass colourless. Press the filter containing the precipitate between folds of filtering paper, and dry it with a gentle heat. Scrape the dry precipitate from the filter, and mix it with the animal charcoal. Pour on them nine ounces of the rectified spirit, digest for half-an-hour, and boil for ten minutes. Filter while hot, wash the charcoal with an ounce of boiling spirit, and set the filtrate aside for two days in a cool dark place to crystallise. Separate the mother-liquor from the crystals, and concentrate to obtain a further product. Collect the crystals, let them drain, redissolve them in four ounces of boiling spirit, and let the solution crystallise as before. Lastly, dry the crystals on filtering paper, in the dark, and preserve them in a bottle protected from light.*

Rationale.—The lime abstracts all the santonin from the santonica, and with it extractive, colouring matter, &c. The santonin having but a feeble affinity for the lime, is readily precipitated by the hydrochloric acid, chloride of calcium remaining in solution. After the removal of the supernatant liquid, containing the chloride of calcium and oily matter, the santonin is obtained still in combination with impurities, which are removed by the subsequent part of the process, advantage being taken of its solubility in boiling, and its comparative insolubility in cold alcohol.

CHARACTERS.—*Colourless flat rhombic prisms, feebly bitter, fusible and sublimable by a moderate heat; scarcely soluble in cold water, sparingly in boiling water, but abundantly in chloroform, and in boiling rectified spirit. Sunlight renders it yellow.*

PURITY TEST.—*Not dissolved by diluted mineral acids. Entirely destructible by a red heat with free access of air.*

Dose.—Of powder of santonica (wormseed), twenty to sixty or more grains; of santonin, for a child, according to age, half-a-grain to three grains; for an adult, five to ten grains; the dose to be repeated three or four times, a dose each night, or on alternate nights, followed, if necessary, by a brisk cathartic.

Santonin, as well as santonica or wormseed, which is seldom used, acts as an anthelmintic, and is said to be especially useful in the treatment of the round worm (*Ascaris lumbricoides.*) In over-doses,

it is apt to produce nausea, vomiting, and severe tenesmus. A yellow or green discoloration of vision occasionally results from its use, which soon passes off, after the drug is discontinued.

Anthemidis Flores—Chamomile Flowers.—Officinal plant: *Anthemis nobilis*, Linn. *Syngenesia Polygamia Superflua;* Common Chamomile. Illustration, plate 980, vol. xiv. *Engl. Bot.* Officinal parts: 1. The flower heads, single and double, dried; wild and cultivated. 2. *Oleum Anthemidis*, Oil of Chamomile, the oil distilled in Britain from Chamomile flowers, Officinal preparations: *Extractum Anthemidis, Infusum Anthemidis.*

Botany.—Root, perennial, with long fibres. *Stems*, herbaceous, procumbent in the wild state, erect when cultivated, much branched, round, furrowed, hollow, eight inches to a foot in length. *Leaves*, doubly pinnate, sessile, somewhat downy; leaflets, linear, subulate, acute. *Flower-heads*, terennial, solitary, with a yellow convex disk, and white reflexed or spreading rays. *Habitat*, indigenous; cultivated at Mitcham and elsewhere.

CHARACTERS OF THE FLOWERS.—*The single variety consists of both yellow, tubular, and white strap-shaped florets; the double, of white strap-shaped florets only; all arising from a conical scaly receptacle; both varieties, but especially the single, are bitter and very aromatic.*

CHARACTERS OF THE OIL.—*Pale blue or greenish-blue, but gradually becoming yellow; with the peculiar odour and aromatic taste of the flowers.*

The single flowers yield most volatile oil, and are to be preferred to the double flowers for medicinal purposes; besides this oil, the flowers contain bitter extractive, tannin, &c. The oil of chamomile, according to Gerhardt, consists of a liquid hydrocarbon, and an oxidised substance, which when treated with potash yields valerianic acid.

EXTRACTUM ANTHEMIDIS—EXTRACT OF CHAMOMILE.—*Take of chamomile flowers,* 1 *pound; oil of chamomile,* 15 *minims; distilled water,* 1 *gallon. Boil the chamomile with the water until the volume is reduced to one-half, then strain, press, and filter. Evaporate the liquor by a water-bath until the extract is of a suitable consistence for forming pills, adding the oil of chamomile at the end of the process.*

INFUSUM ANTHEMIDIS—INFUSION OF CHAMOMILE.—*Take of chamomile flowers,* ½ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for fifteen minutes, and strain.*

Dose.—Of the extract, two to ten grains; of the infusion, one to two or more fluid ounces; of the oil, two to five or more minims.

Chamomile acts as an aromatic bitter tonic, and was formerly also esteemed as a febrifuge. It is chiefly used in the present day as a domestic medicine for the treatment of simple atonic dyspepsia; the extract is a useful adjunct to purgative medicines in form of pill. A strong tepid infusion is sometimes given to promote the action of emetics; the infusion is also used externally as a fomentation.

Taraxaci Radix—Dandelion Root.—Officinal plant: *Taraxacum Dens Leonis,* DC; *Syngenesia Polygamia Æqualis;* Common Dandelion. Illustration, plate 3, *Woodv. Med. Bot.* Officinal parts: The fresh roots, gathered between September and February, from meadows and pastures in Britain. Officinal preparations: *Decoctum Taraxaci, Extractum Taraxaci, Succus Taraxaci.*

Botany.—Herbaceous, perennial. *Root,* spindle-shaped, smooth, dark-brown externally, white within. *Leaves,* radical, runcinate, broad, dentate, glabrous, bright shining green. *Scape,* simple, erect, with a single head of flowers of a golden-yellow colour. *Fruit,* yellow, somewhat compressed. *Habitat,* indigenous, in fields and waste places.

CHARACTERS.—*Tap-shaped roots, smooth and dark-brown externally, white within, easily broken, and giving out an inodorous, bitter, milky juice, which becomes pale-brown by exposure.*

PURITY TEST.—*Not wrinkled or pale-coloured externally; juice not watery; any adherent leaves runcinate and quite smooth.*

The roots of other plants may be substituted for that of Taraxacum, but the latter may be recognised by the above characters, and readily by the smooth, runcinate appearance of the leaves when adherent. The roots are to be gathered between September and February, at which period the juice is thick, bitter, and yields a large amount of extract. Besides other constituents, the juice contains a bitter principle termed *Taraxacin,* which is soluble in water and in alcohol.

SUCCUS TARAXACI—JUICE OF TARAXACUM.—*Take of fresh dandelion root,* 7 *pounds; rectified spirit, a sufficiency. Bruise the dandelion root in a stone mortar; press out the juice; and to every three measures of juice add one of the spirit. Set aside for seven days, and filter. Keep it in a cool place.*

DECOCTUM TARAXACI—DECOCTION OF DANDELION.—*Take of dried dandelion root, sliced and bruised,* 1 *ounce; distilled water,* 1 *pint. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.*

EXTRACTUM TARAXACI—EXTRACT OF DANDELION.—*Take of fresh dandelion root,* 4 *pounds. Crush the root; press out the juice, and allow it to deposit; heat the clear liquor to* 212°, *and maintain the temperature for ten minutes; then strain, and evaporate by a water-bath at a temperature not exceeding* 160°, *until the extract has acquired a suitable consistence for forming pills.*

Dose.—Of the docoction, one, two, or more fluid ounces; of the extract, ten to thirty grains; of the juice, one to two fluid drachms.

Taraxacum in moderate doses acts as a tonic and alterative; in large doses as a diuretic and aperient. It is useful in hepatic affections, and in dyspepsia and other secondary diseases resulting from derangement of the biliary organs.

Arnicæ Radix—Arnica Root.—Officinal plant: *Arnica Montana*, Linn.; *Syngenesia Polygamia Superflua;* Mountain Arnica. Illustration, plate 123, *Steph. and Church. Med. Bot.* Officinal part: The dried rhizome and rootlets; collected in middle and southern Europe. Officinal preparation: *Tinctura Arnicæ.*

Botany.—Perennial herb. *Stem,* about a foot high, hairy, striated. *Radical leaves,* obovate, entire, five-ribbed; *cauline leaves,* in one or two pairs, lanceolate. *Heads,* many-flowered; *florets,* yellow. *Fruit,* cylindrical, hairy. *Habitat,* meadows of middle and southern Europe, and northern parts of America and Asia.

CHARACTERS.—*Rhizome from one to three inches long, and two or three lines thick, cylindrical, contorted, rough from the scars of the coriaceous leaves, and furnished with numerous long slender fibres; has a peppery taste and peculiar odour.*

The flowers, and occasionally the leaves, of arnica are used in medicine, as well as the rhizome. Besides other constituents, the plant contains a resin, a volatile oil, and an alkaloid termed *Arnicina.*

TINCTURA ARNICÆ—TINCTURE OF ARNICA.—*Take of arnica root, in coarse powder, 1 ounce; rectified spirit, 1 pint. Macerate the arnica for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.*

Dose.—Of the tincture, one to two fluid drachms. Externally, the tincture is applied to sprains and bruises, either alone, diluted with water, or added to other lotions. The powdered root may be given in doses of five or ten to twenty grains; or the root, flowers, or leaves may be given in the form of infusion.

Arnica acts in over-doses as an acro-narcotic, producing a burning sensation in the throat, nausea, vomiting, purging, vertigo, &c. In medicinal doses it has been classed with stimulants, aromatics, diaphoretics, narcotics, and in its external application, with sedatives and deobstruents. It is highly esteemed in some parts of the Continent, but has not met with the same acceptance in this country, although it has been lauded by homœopathists. As an internal remedy it has been recommended in adynamic fevers and asthenic inflammations, in paralytic and nervous affections, in amaurosis, in chronic rheumatism, and in other cases in which debility and inactivity are remarkable, its use being contra-indicated in cases in which there is a tendency to sthenic inflammation, internal congestion, or hemorrhage. Externally, it is extensively employed as an application to sprains, bruises, ecchymoses, &c., and has received the significant appellation of *Panacea lapsorum.* It may be applied in the form of cataplasm or lotion.

PYRETHRI RADIX—Pellitory Root.—The root of Anacyclus Pyrethrum *De Cand.*, imported from the Levant. Officinal preparation: *Tinctura Pyrethri.*

Characters.—*In pieces about the length and thickness of the little finger, covered with a thick brown bark, studded with black shining points. Breaks with a resinous fracture, and presents internally a radiated structure. When chewed, it excites a prickling sensation in the lips and tongue, and a glowing heat.*

TINCTURA PYRETHRI—Tincture of Pellitory.—*Take of pellitory root, in coarse powder, 4 ounces; rectified spirit, 1 pint. Macerate the pellitory for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.*

The tincture is not used internally, but diluted in about seven parts of water; it is employed by dentists as a wash for the mouth. Pellitory acts as a powerful local irritant and stimulant, causing a profuse flow of saliva when chewed. It is used as a masticatory in toothache, tic douloureux, paralysis of the tongue, rheumatic affections of the jaws, relaxation of the uvula, &c. Thirty to sixty grains of the root may be chewed at one time as a masticatory.

LACTUCA—Lettuce.—The flowering herb of *lactuca virosa*, Linn. The strong-scented lettuce. Officinal preparation: *Extractum Lactucæ.*

Botany.—Stem, erect, round, marked with blood-red spots. *Leaves,* horizontal, obtuse, arrow-shaped at the base. *Root,* tap-shaped. The herb attains a height of two to four feet, has yellow flowers, larger than those of the common garden lettuce, and the entire plant is filled with a fetid milky juice. It is an indigenous biennial, flowers in August and September, and is found abundantly in the hedgerows.

The juice of the leaves in the flowering season has a strong opiate odour and a bitter taste; it has an acid reaction, and contains lactucin, an odorous principle, lactucerin, albumen, extractive, resin, and some salts. When exposed to the atmosphere it turns first yellow and then brown, and ultimately solidifies into lactucarium. This variety of lettuce is more distinctly narcotic than the other, but still only to a comparatively slight extent.

Garden Lettuce—Lactuca Sativa—was also formerly officinal. Its chemistry and actions are similar to those of Lactuca virosa, only the latter are not so active.

Lactucarium, called also *Lettuce Opium,* is the inspissated juice of both varieties of lettuce, *L. virosa* being generally preferred. It is obtained, about the flowering period, either by incisions, or by slicing the stem, slice after slice, and collecting the juice as it exudes. It is scraped off the plant whilst soft, and allowed to dry in glass or earthenware vessels spontaneously. Lettuce opium is usually met with in small

lumps, seldom larger than a pea or bean, irregular in shape, friable, reddish-brown, sometimes covered with an ash-grey efflorescence, has somewhat the odour of opium, and a bitter taste. The variety obtained from *L. sativa* is often met with in larger pieces, occasionally weighing several ounces. Lactucarium acts as a sedative, anodyne, hypnotic, and antispasmodic, operating as a direct sedative of the circulatory system without any previous acceleration. It may be used as a substitute for opium in cases in which the objections to that drug are insuperable. The great drawback to the use of lactucarium is the uncertainty of its action. It may be given in doses of three, five, ten, or more grains. The Edinburgh Pharmacopœia had a *Tinctura Lactucarii,* given in doses of from twenty minims to a fluid drachm, and *Trochisci Lactucarii,* each of which weighed ten grains, and contained one-sixth of a grain of lactucarium.

EXTRACTUM LACTUCÆ—EXTRACT OF LETTUCE.—*Take of the flowering herb of lettuce,* 112 *pounds. Bruise in a stone mortar, and press out the juice; heat it gradually to* 130°, *and separate the green colouring matter by a calico filter. Heat the strained liquor to* 200° *to coagulate the albumen, and again filter. Evaporate the filtrate by a water-bath to the consistence of a thin syrup; then add to it the green colouring matter previously separated, and stirring the whole together assiduously, continue the evaporation at a temperature not exceeding* 140°, *until the extract is of a suitable consistence for forming pills.*

This extract is admitted from the London Pharmacopœia. Though differing from lactucarium, it probably possesses its medicinal virtues, at least to a considerable degree. Like lactucarium, it is given as a soporific in cases in which opium disagrees, more especially in the fatiguing cough of bronchitis.

Dose.—Five to fifteen grains.

Inula Helenium—Elecampane—is an indigenous plant, having a thick, branching, perennial root, and bright yellow flowers upon a stem from three to five feet high. The plant contains, besides other constituents, a soft resin, extractive, elecampane camphor (Helenin), a starchy substance (Inulin), and a volatile oil. The root was formerly officinal, but is now seldom used. It acts as an aromatic stimulant, tonic, expectorant, and diaphoretic. *Dose* of the powdered root, twenty to sixty grains. It entered into the *Confectio Piperis* of the London Pharmacopœia, but has been omitted from that of the British Pharmacopœia.

Artemisia Absinthium—Wormwood—was formerly officinal. The plant is indigenous, bearing flowers of a dingy yellow colour. It has a bitter aromatic taste and peculiar odour. The dried herb, or the flowering top, is used as an aromatic bitter tonic, and also as an anthelmintic, as its name implies. It may be given in powder in doses of thirty to sixty grains; it is also administered in the form of wine, tincture, and infusion. On the Continent it is largely used in the preparation of certain liqueurs.

Cichorium Intybus—Wild Succory or Chicory—an indigenous plant, is much cultivated for the sake of its roots, which, when roasted, are added

to, or used as a substitute for, coffee. The root has also medicinal properties, which are allied to those of Taraxacum.

Tancetum vulgare—the Common Tansy—is sometimes used as a tonic and anthelmintic. *Carduus Benedictus*, and other species of the genius Carduus, have been used as tonics and febrifuges. *Tussilago Farfara*—Coltsfoot—is employed as a domestic remedy in chronic coughs and pulmonary complaints, &c.

LOBELIACEÆ—The Lobelia Order—Lactescent herbs or shrubs, inhabiting tropical and sub-tropical climates. The plants generally contain an acro-narcotic milky juice, and are frequently poisonous. Officinal plant: *Lobelia inflata.*

Lobelia—Lobelia.—Officinal plant: *Lobelia inflata*, Linn.; *Pentandria Monogynia;* Indian Tobacco. Illustration, plate 19, *Bigelow's Med. Bot.* Officinal part: The herb in flower, dried; imported from North America. Officinal preparations: *Tinctura Lobeliæ, Tinctura Lobeliæ Ætherea.*

Botany.—Annual or biennial herb. *Root*, fibrous. *Stem*, erect, angular, branched at the upper part and smooth, hairy below. *Leaves*, hirsute, irregularly serrate, and either oblong and obtuse or ovate-acute. *Inflorescence*, racemose, flowers small, light blue. *Fruit*, capsular, two-celled. *Seeds*, numerous, small, brown. *Herb*, one to two feet in height. *Habitat*, North America.

Characters.—*Stem angular; leaves alternate, ovate, toothed, somewhat hairy beneath; capsule ovoid, inflated, ten-ribbed; herb acrid. Usually in compressed rectangular parcels.*

The plant yields a milky juice when punctured in any part; but the root and the inflated capsule possess the medicinal properties to the greatest extent. It is usually met with in compressed square cakes, is of a pale greenish-looking colour, has a disagreeable odour, and a burning acrid taste. The chief constituents of the plant are *Lobelina*, a liquid alkaloid to which the narcotic properties are probably due; *Lobelic acid*, an acrid resin, and volatile oil.

TINCTURA LOBELIÆ—Tincture of Lobelia.—*Take of lobelia, in coarse powder, 2½ ounces; proof spirit, 1 pint. Macerate the lobelia for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

TINCTURA LOBELIÆ ÆTHEREA — Ethereal Tincture of Lobelia.—*Take of lobelia, in coarse powder, 2½ ounces; spirit of ether, 1 pint. Macerate for seven days in a closed vessel, with occasional agitation; then strain, press, filter, and add sufficient spirit of ether to make one pint.*

Dose.—Of the powder, one to five grains, as an expectorant; in larger doses it acts as an emetic, not always safe. Of either of the tinctures, ten minims to one half-drachm.

Antidotes.—Facilitate vomiting for the removal of the poison; allay gastro-intestinal irritation by demulcents and opiates; counteract the depressing effects by active stimulants.

Lobelia acts in small doses as a sedative, diaphoretic, and expectorant; in larger doses, as an effectual nauseating, depressing emetic, hence sometimes called *Emetic Weed*. In over-doses the nausea and vomiting are very distressing; purging also attends its action in these cases, and extreme depression ensues, preceded by headache, vertigo, and muscular tremors. In excessive doses it acts as an acro-narcotic poison, the symptoms already mentioned are more fully developed, and death is not unfrequently preceded by convulsions. Lobelia is chiefly employed in spasmodic asthma, humoral asthma, whooping-cough, &c., and in those cases in which tobacco, which it resembles in effect, though it does not act so powerfully, has been recommended. It has been given as an emetic in croup and other cases, but its nauseating and depressing effects are too powerful and too long-continued to admit of safe use in children's complaints; and indeed in any case its action must be carefully watched.

STYRACACEÆ or SYMPLOCACEÆ—The Storax Order.—Trees and shrubs, chiefly inhabiting tropical and sub-tropical regions. The plants possess bitter, aromatic, or stimulant properties. Officinal plant: *Styrax Benzoin*. It is convenient to place here also *Liquidambar orientale* of the natural order Altingiaceæ or Balsamifluæ, the Liquidambar order, the plants of which are natives of the warmer parts of India and America, and some of which are also found in the Levant.

Benzoinum — Benzoin. — Officinal plant: *Styrax Benzoin*, DC; *Decandria Monogynia;* the Benzoin Tree. Illustration, plate 12, vol. lxxvii. *Phil. Trans.* Officinal part: A resinous exudation from the stem; imported from Siam and Sumatra. Officinal preparations: *Acidum Benzoicum, Tinctura Benzoini Composita, Adeps Benzoatus.*

Botany.—A tree of considerable size. *Stem*, about the thickness of a man's body. *Leaves*, entire, oval-oblong. *Inflorescence*, racemose. *Flowers*, grey. *Habitat*, Sumatra, Borneo, Siam, and Java.

CHARACTERS.—*In lumps, consisting of agglutinated tears, or of a brownish mottled mass with or without white tears imbedded in it; has little taste, but an agreeable odour; gives off, when heated, fumes of benzoic acid; and is soluble in rectified spirit and in solution of potash.*

In Sumatra, benzoin is obtained from incisions made into the bark of the stem of a tree six years old. From these the balsam exudes and concretes. Each tree yields about three pounds annually for ten or twelve years, and according to the period of its produce the balsam receives qualifying titles. During the first three years it is called *head benzoin*, and is white; afterwards the balsam is brownish, and is called *belly benzoin;* and when the tree ceases to furnish it spontaneously, it is

felled and split, and the benzoin, which is then scraped from its interstices, is called *foot benzoin.* The first is the best, the second not half so good, and the third only about one-fifth of the value of the first. Benzoin is known in commerce as *Siam* and *Sumatra* Benzoin, and may be either in tears or in lump. It is hard but friable, and has a resinous fracture, a sweetish balsamic taste, and an agreeable odour. When heated it emits white irritating fumes of benzoic acid, with an empyreumatic oil. It is soluble in alcohol and in ether, and forms a milky emulsion with water. It consists chiefly of resin, benzoic acid, and other minor ingredients, with a trace of volatile oil.

TINCTURA BENZOINI COMPOSITA—COMPOUND TINCTURE OF BENZOIN.—*Take of benzoin, in coarse powder,* 2 *ounces; prepared storax,* $1\frac{1}{2}$ *ounce; balsam of tolu,* $\frac{1}{2}$ *ounce; socotrine aloes,* 160 *grains; rectified spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient rectified spirit, if required, to make one pint.*

Dose.—Of powdered benzoin (very rarely given in the solid state), ten to twenty grains; of the compound tincture, one to two fluid drachms, seldom alone, but as an adjunct to pectoral mixtures; it is decomposed by water, and therefore requires mucilage, sugar, or yolk of egg to keep it in suspension in the form of an emulsion. *Court* or *Black sticking-plaster* is prepared by painting black sarcenet first with a coat of isinglass, and then with an alcoholic solution of benzoin.

Benzoin acts in the same manner as the other true balsams, but is more apt to cause irritation of the stomach and bowels in susceptible persons. It is used as a stimulating expectorant, and as a very slight tonic in chronic pulmonary disorders; but in consequence of its stimulating properties, it is contra-indicated in acute cases. It is occasionally used by fumigation in affections of the throat, as in chronic laryngitis. By some it is said to act in a stimulating manner upon the sexual organs. In all cases it is better adapted to persons of sluggish constitutions than to those of nervous temperament. The compound tincture is sometimes applied as a stimulant to flabby ulcers, and also to freshly incised wounds; in the latter case it should not be applied to the raw surface of the wound, but to the outer surface, after the edges have been carefully placed in apposition, otherwise it would prevent healing by the first intention; its effect is merely the mechanical one of excluding the air. Benzoin enters into various kinds of fumigating pastilles used in sick rooms to overcome unpleasant odours, a mischievous practice, unless the unpleasant odour be merely of a temporary character, and its cause recognised. Benzoin possesses also the power of diminishing greatly the tendency of fats to become rancid, a property of which advantage is taken in the preparation of Adeps Benzoatus.

Acidum Benzoicum—Benzoic Acid.—An acid, ($HO,C_{14}H_5O_3$, or $HC_7H_5O_2$), obtained from benzoin by sublimation.

PREPARATION.—*Take of benzoin, 4 ounces. Place the benzoin in a cylindrical pot of sheet iron, furnished with a flange at its mouth; and, having fitted the pot into a circular hole in a sheet of pasteboard, interpose between the pasteboard and flange a collar of tow, so as to produce a nearly air-tight junction. Let a cylinder of stiff paper, open at one end, eighteen inches high, and having a diameter of at least twice that of the pot, be now inverted on the pasteboard, and secured to it by slips of paper and flour paste. Pass two inches of the lower part of the pot through a hole in a plate of sheet tin, which is to be kept from contact with the pasteboard by the interposition of a few corks; and let a heat just sufficient to melt the benzoin (that of a gas lamp answers well) be applied, and continued for at least six hours, that benzoic acid may be sublimed. Let the product thus obtained, if not quite white, be pressed firmly between folds of filtering paper, and again sublimed.*

CHARACTERS.—*In light feathery crystalline plates and needles, which are flexible, nearly colourless, and have an ageeeable aromatic odour, resembling that of benzoin. It is sparingly soluble in water, but is readily dissolved by rectified spirit; soluble also in solutions of the caustic alkalies and of lime, and it is precipitated from these on the addition of hydrochloric acid unless the solution be very dilute. It melts at* 248°, *and boils at* 462°.

PURITY TEST.—*When heated to the last-named temperature, it passes off in vapour leaving only a slight residue.*

Benzoic acid of commerce occurs in soft, white, plumose crystals, or in scales, flexible, transparent, and of pearly lustre It is inodorous when quite pure, but when prepared by sublimation it receives the odour of the volatile oil, which is volatilised and condensed with it. It has a warm, sour taste. It burns with a bright yellow flame, readily fuses and volatilises, the fumes causing severe irritation of the air-passages when respired. It is scarcely soluble in cold water, more so in hot water, and readily in alcohol. It possesses the properties of an acid feebly. Benzoic acid may be distinguished from cinnamic acid by not yielding oil of bitter almonds when distilled with an oxidising agent. It is not usually adulterated, but may be impure from faulty preparation, and if so it should be resublimed.

Dose.—Five to twenty or thirty grains, in a large quantity of water, so as to diminish its irritating action upon the mucous membrane of the throat and gullet. It is rarely used alone. Benzoate of ammonia is more soluble, and therefore preferable. Benzoic acid enters into *Tinctura Camphoræ Composita, Ammoniæ Benzoas, and Tinctura Opii Ammoniata.*

Benzoic acid acts as a topical irritant, causing heat and acridity of the mouth and fauces when swallowed, and a sensation of heat in the stomach. It acts generally as a stimulant, especially of mucous membranes. It passes out of the system by the urine in the form of hippuric acid ; but it probably does not affect the quantity of the urea and uric acid, as was suggested. It is very

rarely used alone, but it is occasionally given as a stimulating expectorant in chronic bronchial affections. It has also been given with the view of changing the condition of the urine in cases threatening deposits; but its success in these cases has not been substantiated, and if it neither affects the urea nor uric acid of the urine it is probably inoperative.

Styrax Præparatus—Prepared Storax.—Officinal plant: *Liquidambar orientale—Miller's Dict.* Illustration, plate, *Pharm. Journ.* vol. xvi. page 462. Officinal part: A balsam, obtained from the bark in Asia Minor, purified by means of rectified spirit and straining. Officinal preparation: Enters into *Tinctura Benzoini Composita.*

Botany.—A tree from fifteen to fifty or sixty feet in height, with smooth bark. *Leaves,* palmately five-cleft, alternate, ovate, smooth, villous beneath. *Inflorescence,* racemose, flowers white. *Fruit,* capsular, downy, two-celled; one, two, or many-seeded. *Habitat,* Asia Minor. Formerly the storax of commerce was derived from *Styrax officinale,* a small tree inhabiting Asia Minor, Syria, common in Greece, and cultivated in the south of Europe.

CHARACTERS.—*A semi-transparent brownish-yellow semi-fluid resin, of the consistence of thick honey, with a strong agreeable fragrance and aromatic bland taste. Heated in a test-tube on the vapour bath, it becomes more liquid, but gives off no moisture; boiled with solution of bichromate of potash and sulphuric acid, it evolves the odour of hydride of benzoyle.*

The balsam is obtained from the inner bark of the tree, partly by pressure and partly by boiling, and is subsequently purified by means of rectified spirit and straining. Two kinds of storax are met with in commerce, and of these there are several qualities. 1. *Liquid Storax,* the officinal kind, which is of a brownish-yellow colour and tenacious, has a warm balsamic taste, and aromatic odour. 2. *Styrax Calamita,* which is solid, very inferior, and contains, besides other substances, sawdust and turpentine, which, together with a balsamic resin and benzoin, form brownish friable cakes. Storax is chiefly imported from Trieste. Its chief constituents are a volatile oil (Styrole, C_8H_8), which is colourless, and exceedingly volatile; a crystallisable substance (Styracine); two resins, hard and soft; and cinnamic acid. *Cinnamic Acid,* $HC_9H_7O_2$, exists also in the balsams of Peru and Tolu, and in the resin of xanthorrhœa, as well as in liquid storax, and is formed also by the oxidation of oil of cinnamon. It is a colourless, crystalline acid, with a feebly aromatic and acrid taste. It resembles benzoic acid, but may be distinguished from it by affording oil of bitter almonds when treated with an oxidising agent. Like benzoic acid, it passes out of the system by the urine in the form of hippuric acid.

Dose.—Ten to twenty grains; but is seldom given alone; it enters into the compound tincture of benzoin. The old compound storax pill contained opium, saffron, and storax, the latter being added merely to disguise the opium.

Storax acts as a stimulant, especially of the respiratory mucous

membrane, and, like the other true balsams, may be used as a stimulating expectorant.

Sub-Class III.—Corollifloræ.

1. *Hypostamineæ.*

ERICACEÆ—The Heath Order.—Shrubs or under-shrubs, abounding at the Cape of Good Hope, and occurring also in Europe, America, and Asia. Some of the plants possess astringent properties, the fruits of some are edible, and of others poisonous. Officinal plant: *Arctostaphylos Uva Ursi.*

Uvæ Ursi Folia—Bearberry Leaves.—Officinal plant: *Arctostaphylos Uva ursi*, Spreng. Syst.; *Decandria Monogynia;* The Bearberry. Illustration, plate 70, *Woodv. Med. Bot.* (*Arbutus Uva ursi*). Officinal part: The dried leaves; from indigenous plants. Officinal preparation: *Infusum Uvæ Ursi.*

Botany.—A small evergreen procumbent shrub. *Stem,* woody, round, and trailing. *Leaves,* coriaceous, alternate, stalked, evergreen, obvate, entire shining, upper surface dark-green, under surface paler and reticulated. *Flowers,* in small terminal racemes; corolla rose-coloured. *Fruit,* a globose, scarlet berry, having a sharp astringent taste, and containing rarely more than four or five fully developed, more or less cohering, seeds. *Habitat,* indigenous; rugged stony districts of Europe, Asia, and America.

Characters. — *Obovate entire coriaceous shining leaves, about three-fourths of an inch in length, reticulated beneath; with a strong astringent taste, and a feeble hay-like odour when powdered; the infusion giving a bluish-black precipitate with perchloride of iron.*

Purity Test.—*Leaves not dotted beneath nor toothed on the margin.*

The dried leaves are dark shining green, inodorous, but have a bitter astringent taste, and are reticulated on their under surface. The leaves of the Red Whortleberry (*Vaccinium Vitis Idæa*) are apt to be substituted for the true leaves. They are known by their serrated margin and dotted under surface. The leaves of Uva ursi contain tannic and gallic acids, a neutral crystallisable substance termed *Arbutin,* resin, volatile oil, extractive, and two substances named respectively *Ursin* and *Urzone.*

INFUSUM UVÆ URSI—Infusion of Bearberry.—*Take of bearberry leaves, bruised,* ½ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for two hours, and strain through calico.*

Dose.—Of the infusion, one, two, or more fluid ounces. The powdered leaves may be given in doses of twenty to sixty grains; but the bulk of such doses is objectionable. The old extract was used in doses of five to ten grains.

Uva ursi, in consequence of the tannic and gallic acids contained in the leaves, acts as a pure vegetable astringent. It acts also as a

diuretic, at the same time modifying the condition of the urine. In over-doses it causes nausea. Its uses are the same as those of vegetable astringents generally, but it is especially applicable to diseases of the urinary passages of a chronic character, in which there is a more or less profuse mucous discharge, unaccompanied by any active inflammatory symptoms. In *catarrhus vesicæ*, and in certain calculous affections, some writers have observed great benefit from its use, whilst with others it has often completely failed. It is occasionally administered in chronic affections of the respiratory mucous membrane, with profuse mucous or purulent discharge.

PYROLACEÆ — The Winter Green Order.—Herbs, inhabiting northern countries. The leaves and stems of *Chimaphila umbellatta*, *C. corymbosa*, or *Pyrola umbellata*, were formerly officinal. The plant is a small evergreen shrub, with a woody creeping rhizome, ascending and somewhat angular stems, leaves in irregular whorls, evergreen, coriaceous, smooth, and shining. Inflorescence corymbose, corolla white, tinged with red; an inhabitant of the northern latitudes of Europe, Asia, and America. The leaves have a bitter and astringent taste, and a peculiar odour when bruised. The fresh leaves are acrid, probably due to the presence of a volatile oil, and are capable of producing rubefaction and vesication, if applied to the skin after they have been bruised. Internally, chimaphila acts as an agreeable tonic, increasing the appetite. It acts also as a diuretic, diminishing, as some suppose, the amount of lithic acid in the urine. It is used in dropsies associated with debility, acting at once as a tonic and diuretic; in chronic diseases of the urinary organs, as in *catarrhus vesicæ*, and in calculous affections; occasionally also in subacute cases of gonorrhœa, in hæmaturia, &c. It is known in some parts of the United States as *king's cure*, in consequence of its having been employed somewhat successfully in the treatment of scrofula. A decoction is sometimes employed as a wash to unhealthy scrofulous sores. The only officinal preparation was a decoction, given in doses of one to two fluid ounces; but an extract is also used in doses of five to fifteen grains.

2. *Epicorollæ or Epipetalæ.*

OLEACEÆ—The Olive Order.—Trees or shrubs inhabiting temperate climates. The plants of the order possess emollient, laxative, bitter, tonic, or febrifugal properties. Officinal plants: *Olea europæa*, *Fraxinus Ornus*, *Fraxinus rotundifolia.*

Oleum Olivæ—Olive Oil.—Officinal plant: *Olea europæa*, Linn.; *Diandria Monogynia;* The European Olive. Illustration, plate 15, *Steph. and Church. Med. Bot.* Officinal part: The oil, expressed from the fruit in the south of Europe. Officinal preparations: *Linimentum Calcis*, *Linimentum Camphoræ.*

Botany.—A small evergreen tree, having a dense hard wood. *Leaves*, opposite, lanceolate greyish-green. *Inflorescence*, axillary racemes, flowers small and white. *Fruit*, drupaceous, dark bluish-green, with oily pericarp and osseous kernel. *Habitat*, Asia; cultivated on the

shores of the Mediterranean, both in south of Europe and north of Africa.

Characters of Olive Oil.—*Pale yellow, with scarcely any odour, and a bland oleaginous taste; congeals partially at about* 36°.

Besides the fruit, the leaves and bark of the tree, and also a resinous exudation, have been employed from time to time in medicine, the bark chiefly as a substitute for cinchona bark. The fruit, in the unripe state, is preserved in brine, and used as an article of diet. Olive oil is obtained from the fruit by expression. At first the olives, before they are quite ripe, are merely bruised with a very gentle pressure, and the oil then collected is the finest, or *virgin oil.* Boiling water and greater pressure is next resorted to, and the ordinary oil is obtained. Or, the olives (after the virgin oil has been withdrawn) are piled in heaps and allowed to ferment, after which an inferior quality of oil is obtained, which is chiefly used for burning, or for making soaps. Olive oil is a fatty, fixed, or expressed oil, having a yellowish colour, scarcely any odour, and a bland oleaginous taste. It is somewhat soluble in ether, in alcohol, and in the fixed oils, but not in water. It is not, like linseed oil, a drying oil, but becomes rancid by exposure to the atmosphere, through the absorption of oxygen. At moderately low temperatures it divides into two portions, the one fluid and transparent *Elaine* or *Oleine,* the other solid, termed *Margarine,* which has a white pearly aspect; the former constitutes about seventy-two, the latter, about twenty-eight per cent. of the oil. Oleine and Margarine consist respectively of oleic acid and margaric acid, in combination with a base, glycerine.

In doses of one fluid ounce or thereabouts, olive oil acts as a gentle painless laxative. It is but little used internally; but as a laxative, may either be given by the stomach or added to enemata. It is an ingredient of the officinal *Enema Magnesiæ Sulphatis*, *charta Epispastica*, *Cataplasma Lini*, and of several ointments, liniments, and plasters. As an emollient, it acts mechanically as an antidote, in cases of irritant poisoning. Externally, it may be applied as a simple emollient. Two kinds of soap are made with olive oil, *sapo durus* and *sapo mollis*, both of which are officinal; it is also one of the sources of glycerine.

Sapo Durus—Hard Soap.—Soap made with olive oil and soda.

Characters.—*Greyish-white, dry, inodorous: horny and pulverisable when kept in dry warm air; easily moulded when heated.*

Purity Tests.—*Soluble in rectified spirit; not imparting an oily stain to paper. Incinerated, it yields an ash which does not deliquesce.*

Hard, Spanish, or Castile soap, consists of oleic and margaric acids, in union with soda. The mottled kind is coloured by the addition of sulphate of iron, which, on exposure to the air, is converted into red peroxide of iron.

Sapo Mollis—Soft Soap.—Soap made with olive oil and potash.

CHARACTERS.—*Yellowish-green, inodorous, of a gelatinous consistence.*

PURITY TESTS.—*Soluble in rectified spirit; not imparting an oily stain to paper. Incinerated, it yields an ash which is very deliquescent.*

The ordinary soft soap of commerce is made with cheaper substitutes for olive oil, such as fish oil and tallow; it is dark-coloured, and of disagreeable odour. The officinal soap consists of the oleate and margarate of potash. The tests in both cases are to prove the absence of insoluble soaps, and other insoluble ingredients, with unsaponified oil; and to determine that the proper alkali is employed in either case, since if potash is present, the ash is deliquescent, but if soda only, it is not so.

EMPLASTRUM SAPONIS—SOAP PLASTER.—*Take of hard soap, 6 ounces; lead plaster, $2\frac{1}{4}$ pounds; resin, 1 ounce. To the lead plaster, melted by a gentle heat, add the soap and the resin, first liquefied; then, constantly stirring, evaporate to a proper consistence.*

LINIMENTUM SAPONIS—LINIMENT OF SOAP.—*Take of hard soap, cut small, $2\frac{1}{2}$ ounces; camphor, $1\frac{1}{4}$ ounce; oil of rosemary, 3 fluid drachms; rectified spirit, 18 fluid ounces; distilled water, 2 fluid ounces. Mix the water with the spirit, and add the oil of rosemary, the soap, and the camphor. Macerate for seven days at a temperature not exceeding 70°, with occasional agitation, and filter.*

Soap acts internally as an antacid, in the manner of the alkalies, but more mildly. It is seldom given alone, but is a useful adjunct to purgative medicines, of which it is an excellent excipient, rendering them more soluble, and therefore more speedy, and less irritant in their action. Hard soap is an ingredient of compound extract of colocynth, barbadoes aloes pill, aloes and assafœtida pill, socotrine aloes pill, compound pill of gamboge, compound rhubarb pill, compound squill pill, compound soap pill (the opium pill of the British Pharmacopœia, 1864). It enters also into resin and soap plasters, soap liniment, and liniment of iodide of potassium with soap. Soft soap is an ingredient in liniment of turpentine. Externally, soap acts as a detergent and discutient. Soap liniment (*Opodeldoc*) is applied with friction to bruises, sprains, rheumatic pains, &c., and forms one-half by volume of Linimentum Opii. Soap plaster is employed as a discutient, and also to give mechanical support to weak parts. Soap is used also as an antidote in cases of poisoning by the mineral acids; it may be given in strong solution. Dissolved in water, it is also employed as an enema in habitual constipation, or to facilitate the action of purgatives.

Glycerinum—Glycerine.—A sweet principle ($C_6H_8O_6$, or $C_3H_8O_3$), obtained from fats and fixed oils, and containing a small per-centage of water.

CHARACTERS.—*A clear, colourless fluid, oily to the touch, without odour,*

of a sweet taste; freely soluble in water and in alcohol. When decomposed by heat, it evolves intensely irritating vapours. Purity Test.—*Sp. gr.* 1·25.

Glycerine is a product in the process of saponification, and is obtained in a pure state from the residuary liquor of a soap manufactory, by first evaporating it, and then heating it with alcohol, which dissolves the pure glycerine out of the mass. The spirit is ultimately distilled off, and the residual glycerine is further purified by animal charcoal. It is also readily obtained in the manufacture of stearic acid candles. Glycerine exists in the fats and oils, as a base in union with oleic, margaric, and stearic acids.

Glycerine acts as an emollient and nutrient. It is, besides, an excellent solvent, and is possessed of considerable antiseptic powers. Its solvent and antiseptic properties are utilized in the preparations introduced for the first time into the second edition of the "British Pharmacopœia," under the term glycerines. These are five in number—Glycerine of borax, of tannin, of gallic acid, of carbolic acid, and of starch. Glycerine, by itself, is chiefly used externally as an emollient application to chaps, sores, and skin diseases; and when added in small proportions to lotions and poultices, it renders them more soothing and emollient, and keeps the parts longer moist. It is used as an emollient application to the ear, and also to soften the hard dry tongue of fever. It is sometimes given as a substitute for cod-liver oil, in cases in which the objections to the latter are insuperable, but it is of incomparably less value. When so administered, it is given in doses of from one drachm to half-an-ounce. Glycerine enters also into *Linimentum Potassii Iodidi cum Sapone.*

Manna—Manna.—Officinal plants: *Fraxinus Ornus,* Linn., and *Fraxinus rotundifolia,* DC; *Diandria Monogynia;* the European Flowering or Manna Ash, and the Round-leaved Flowering or Manna Ash. Illustration, plate 53, *Steph. and Church Med. Bot.* Officinal part: A concrete saccharine exudation from the stem, obtained by incisions; imported from Calabria and Sicily.

Botany.—Fraxinus Ornus, a small tree, with large, opposite, imparipinnate leaves, with seven to nine leaflets. *Inflorescence,* large, many-flowered panicles. *Flowers,* small, polygamous, yellowish or greenish-white. *Fraxinus rotundifolia,* a small tree, with opposite pinnate leaves, four to nine leaflets; possibly merely a variety of the former species. *Habitat,* south of Europe, Calabria, Sicily.

Characters.—*In stalactiform pieces from one to six inches in length, and one or two inches in width, uneven, porous, and friable, curved on one side, of a yellowish-white colour, with a faintly nauseous odour, and a sweetish taste. It consists principally of mannite,* $C_6H_7O_6$, *or* $C_3H_7O_3$, *together with common sugar and extractive matter. The mannite, which forms from* 60 *to* 80 *per cent. of the manna, may be extracted by means of*

boiling rectified spirit, from which it will afterwards separate on cooling in colourless, shining crystals. It requires five parts of cold water for its solution, and this does not undergo vinous fermentation in contact with yeast.

Several varieties of manna are recognised in commerce, such as Flake Manna, Manna in tears, Manna in sorts, Fat Manna, Tolfa Manna, &c. Manna consists of mannite, sugar, gum, extractive, resin, &c.

Dose.—Sixty grains to one ounce.

Manna acts as a laxative, and in large doses is apt to produce griping and flatulence. It is chiefly used, for the sake of its sweet taste, to flavour other medicines for children.

ASCLEPIADACEÆ—The Milkweed Order.—Latescent, often twining shrubs or herbs, chiefly inhabiting tropical regions. The plants possess acrid, stimulant, purgative, diaphoretic, and emetic properties. Officinal plant : *Hemidesmus indicus.*

Hemidesmi Radix—Hemidesmus Root.—Officinal plant : *Hemidesmus indicus*, DC. *Wight. Icon. Plant. Ind. Orient.*, vol. ii., plate 594. Officinal part : The root, dried ; imported from India. Officinal preparation : *Syrupus Hemidesmi.*

Botany.—A twining glabrous shrub, with long cylindrical roots, twining, woody, slender stems, opposite acute, entire leaves, shining above, and small greenish-purple flowers, in cymes.

CHARACTERS.—*Yellowish-brown, cylindrical, tortuous, furrowed, and with annular cracks, having a fragrant odour, and a very agreeable flavour.*

SYRUPUS HEMIDESMI — SYRUP OF HEMIDESMUS.— *Take of hemidesmus root, bruised,* 4 *ounces; refined sugar,* 28 *ounces; boiling distilled water,* 1 *pint. Infuse the hemidesmus in the water, in a covered vessel, for four hours, and strain. Set it by till the sediment subsides; then decant the clear liquor, add the sugar, and dissolve by means of a gentle heat. The product should weigh two pounds ten ounces, aud should have the specific gravity* 1·335.

Dose.—Of the Syrup, one or two fluid drachms.

Hemidesmus is esteemed in India as an alterative, diaphoretic, and tonic, and is employed as a substitute for sarsaparilla ; but in this country it is used chiefly as a flavouring adjunct.

LOGANIACEÆ or SPIGELIACEÆ—The Strychnia Order.—Shrubs, herbs, or trees, chiefly inhabiting tropical regions. The plants possess highly poisonous properties, producing tetanic spasm. Officinal plant : *Strychnos Nux vomica.*

Nux Vomica—Nux Vomica.—Officinal plant : *Strychnos Nux vomica*, Linn. ; *Pentandria Monogynia.* Illustration, plate 52, *Steph. and Church. Med. Bot.* Officinal part : The seeds ; imported from the

East Indies. Officinal preparations: *Strychnia, Liquor Strychniæ, Extractum Nucis Vomicæ, Tinctura Nucis Vomicæ.*

Botany.—Tree of medium height, with a shortish, often crooked, and thick trunk, irregular branches, and hard, white, bitter wood. *Leaves,* ovate, stalked, and smooth, opposite, shining, and entire. *Inflorescence,* corymbose, corolla funnel-shaped and greenish-white. *Fruit,* a round smooth, one-celled berry, as large as a good-sized apple, covered with a smooth shell, and when ripe, has a rich orange colour. It contains a white, soft, gelatinous pulp, in which are immersed the seeds attached to a central placenta. *Habitat,* Coromandel and other parts of India, and Ceylon.

CHARACTERS OF THE SEEDS.—*Nearly circular and flat, about an inch in diameter, umbilicated and slightly convex on one side, externally of an ash-grey colour, thickly covered with short satiny hairs, internally translucent, tough and horny, taste intensely bitter, inodorous.*

The seeds are roundish and flat, about three-quarters of an inch to an inch in diameter, slightly convex on the dorsal and correspondingly concave on the ventral aspect. On the ventral surface the seed is marked with the hilum or umbilicus, and at one part near the circumference there is a slight prominence, marking the position of the radicle of the embryo; these two points are connected by a more or less distinct raphé. The seeds are difficult to powder; the powder is of a greyish-yellow colour. The bark of nux vomica has been substituted by mistake for angustura bark; the distinguishing characters are mentioned at page 388. The chief constituents of the seeds are three alkaloids, *strychnia, brucia,* and *igasuria,* and an acid, *strychnic* or *igasuric* acid, together with gum, wax, colouring matter, bassorin, &c.

Brucia—$C_{23}H_{26}N_2O_4$—exists both in the bark and seeds of *Strychnos Nux vomica.* It may be obtained either in the anhydrous form of a waxy appearance, or in the form of small oblique rhombic prisms, with eight equivalents of water. Brucia is intensely bitter. It is soluble in strong alcohol, and may thus be separated from strychnia. It is also more soluble than strychnia in water, and its salts are more soluble in water than are the salts of strychnia. Nitric acid produces with brucia a bright-red colour, which quickly changes to yellowish-red, and ultimately to yellow; it is changed to a violent colour by the addition of protochloride of tin. Chlorine also gives a red colour with brucia. Concentrated sulphuric acid gives with brucia a rose-red colour, which soon vanishes. The addition of sulphuric acid and bichromate of potash to a solution of brucia, does not produce the play of colours mentioned under strychnia.

Igasuria is intensely bitter and crystallisable. It is more soluble than brucia in water, and is soluble in weak alcohol, in acids, and in alkalies. It forms soluble, crystallisable, and poisonous salts. Sulphuric acid produces with it a rose colour, which becomes yellowish and greenish. Igasuria is said to be a mixture of various colourless, intensely bitter, and poisonous alkaloids, which may be separated by careful fractional crystallisation.

Strychnic or *Igasuric Acid* exists in nux vomica in union with the alkaloids; it is crystallisable, is soluble in water and in alcohol, and

gives at first a green colour, and ultimately a green precipitate with salts of copper.

Strychnia—Strychnia.—An alkaloid ($C_{42}H_{22}N_2O_4$, or $C_{21}H_{22}N_2O_2$), obtained from nux vomica.

PREPARATION.—*Take of nux vomica,* 1 *pound; acetate of lead,* 180 *grains; solution of ammonia, a sufficiency; rectified spirit, a sufficiency; distilled water, a sufficiency. Subject the nux vomica for two hours to steam in any convenient vessel; chop or slice it; dry it in a water-bath or hot-air chamber, and immediately grind it in a coffee-mill. Digest the powder at a gentle heat for twelve hours with two pints of the spirit and one of the water, strain through linen, express strongly, and repeat the process twice. Distil off the spirit from the mixed fluid, evaporate the watery residue to about sixteen ounces, and filter when cold. Add now the acetate of lead, previously dissolved in distilled water, so long as it occasions any precipitate; filter; wash the precipitate with ten ounces of cold water, adding the washings to the filtrate; evaporate the clear fluid to eight ounces, and when it has cooled add the ammonia in slight excess, stirring thoroughly. Let the mixture stand at the ordinary temperature for twelve hours; collect the precipitate on a filter, wash it once with a few ounces of cold distilled water, dry it in a water-bath or hot-air chamber, and boil it with successive portions of rectified spirit, till the fluid scarcely tastes bitter. Distil off most of the spirit, evaporate the residue to the bulk of about half-an-ounce, and set it aside to cool. Cautiously pour off the yellowish mother-liquor (which contains the brucia of the seeds) from the white crust of strychnia which adheres to the vessel. Throw the crust on a paper filter, wash it with a mixture of two parts of rectified spirit and one of water, till the washings cease to become red on the addition of nitric acid; finally, dissolve it by boiling it with an ounce of rectified spirit, and set it aside to crystallise. More crystals may be obtained by evaporating the mother-liquor.*

Rationale.—After the hard seeds have been softened and prepared for the process by steaming and grinding, they are subjected for twelve hours to the action of a mixture of rectified spirit and water, and are then strained and squeezed. By this part of the process, which is twice repeated, the *igasurates of strychnia and brucia* are separated, together with some extractive and colouring matter. When the spirit has been distilled off from the mixed fluid, and the watery residue has been sufficiently evaporated and filtered, a solution of acetate of lead is added, whereupon a double decomposition ensues, igasurate of lead being precipitated, whilst acetates of strychnia and brucia remain in solution. The precipitate is removed by filtration. Next, after due evaporation, solution of ammonia is added to the clear fluid, whereupon acetate of ammonia is formed in solution, whilst the alkaloids, strychnia and brucia, are gradually precipitated during the subsequent twelve hours. This precipitate is next washed with distilled water, dried, and boiled with rectified spirit; and when the liquor is subsequently evaporated to the bulk of half-an-ounce and cooled, the strychnia, being less soluble than the brucia, crystallises out, forming a crust upon the vessel, whilst the brucia is poured off in the mother-liquor. Finally, any adherent brucia is removed by washing with a mixture of rectified spirit and water, its

entire absence being denoted by the nitric acid test; and the strychnia is recrystallised from its solution in boiling rectified spirit.

CHARACTERS.—*In right square octahedrons or prisms, colourless and inodorous; sparingly soluble in water, but communicating to it its intensely bitter taste; soluble in boiling rectified spirit, and in chloroform, but not in absolute alcohol or in ether. Pure sulphuric acid forms with it a colourless solution, which, on the addition of bichromate of potash, acquires an intensely violet hue, speedily passing through red to yellow.*

PURITY TESTS.—*Not coloured by nitric or sulphuric acid; leaves no ash when burned with free access of air. A very active poison.*

Strychnia crystallises in white lustrous octohedra, or in four-sided prisms, but it is also met with in the form of a granular powder. It is inodorous, but intensely bitter. Cold water dissolves only about one seven-thousandth part of strychnia, but, nevertheless, is rendered distinctly bitter by it. It is soluble in about 2500 parts of boiling water. Strychnia is insoluble in the caustic alkalies, but is soluble in the essential oils. It is fusible, but not volatile; it decomposes at a low temperature. It reacts as an alkali. In addition to its physiological properties, strychnia may be recognised by the following chemical tests. Terchloride of gold gives a reddish-yellow precipitate. Bichloride of platinum gives a yellow granular precipitate. Infusion of galls gives a white precipitate. When dissolved in hydrochloric acid, corrosive sublimate gives a white clotty precipitate. Pure sulphuric acid forms a colourless solution, but on the addition of bichromate of potash a beautifal violet tint is produced, which, passing through red, ultimately becomes brownish-yellow. With perfectly pure strychnia nitric acid does not give a red colour, but with the strychnia of commerce it usually does so in consequence of the presence of brucia and yellow colouring matter. Strychnia is frequently adulterated. Its purity may be known by the above tests. The sulphate, nitrate, and hydrochlorate of strychnia are soluble in water, and more readily so in the presence of free acid.

LIQUOR STRYCHNIÆ — SOLUTION OF STRYCHNIA. — *Take of strychnia, in crystals, 4 grains; diluted hydrochloric acid, 6 minims; rectified spirit, 2 fluid drachms; distilled water, 6 fluid drachms. Mix the hydrochloric acid with four drachms of the water, and dissolve the strychnia in the mixture by the aid of heat. Then add the spirit and the remainder of the water.*

EXTRACTUM NUCIS VOMICÆ—EXTRACT OF NUX VOMICA.—*Take of nux vomica, 1 pound; rectified spirit, a sufficiency. Apply steam to the nux vomica until it is thoroughly softened, then dry rapidly, and reduce to fine powder. Exhaust the powder by boiling it with successive portions of the spirit until the latter comes off nearly free from bitterness. Strain, distil off the spirit, and evaporate by a water-bath to the consistence of a soft extract.*

TINCTURA NUCIS VOMICÆ—TINCTURE OF NUX VOMICA.—*Take of nux vomica, 2 ounces; rectified spirit, 1 pint. Apply steam to the nux vomica until it is thoroughly softened, then dry rapidly, and reduce it to fine powder. Macerate the powder for forty-eight hours in fifteen fluid ounces of the spirit in a closed vessel, agitating occasionally; then*

transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of the spirit. Afterwards, subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.

Dose.—Nux vomica, strychnia, and their preparations, must be used cautiously, and their effects are to be carefully watched. Of powdered nux vomica, one grain cautiously increased to three or four grains ; of the extract of nux vomica, one quarter of a grain, cautiously increased to two or three grains ; of the tincture of nux vomica, ten minims, cautiously increased to thirty. The tincture is intensely bitter : it is also applied externally as an embrocation to paralysed parts. Of strychnia, one-sixteenth, cautiously increased to one-eighth of a grain, given in pill with bread-crumb or confection of roses, the alkaloid being previously dissolved in a drop of rectified spirit or weak acid, so as to ensure its equal distribution throughout the pill mass ; of liquor strychniæ (the strength of which is four grains to the fluid ounce, or half-a-grain to the fluid drachm), five minims, cautiously increased to ten, fifteen, or twenty. Endermically, one-quarter of a grain may be sprinkled upon the surface after the removal of the cuticle.

Note.—Some persons are exceedingly susceptible of the influence of nux vomica and strychnia. Alarming symptoms occurred in a case, mentioned by Andral, in which only one dose of one-twelfth of a grain of strychnia had been taken. And it is to be borne in mind that dangerous, if not fatal, results may supervene suddenly after the preparations have been given in ordinary doses for some time, especially when given in the form of pill.

Antidotes.—Empty the stomach as promptly as possible, either by the stomach-pump or by means of an emetic. The object of treatment is then to oppose the action of the poison either chemically, mechanically, or physiologically, and to treat the symptoms as they arise. There is no known chemical antidote, but substances containing tannin, such as strong tea or infusion of galls, may be tried, with the view of forming tannate of strychnia. Animal charcoal has been recommended in large doses, with the view of interposing a mechanical obstruction to the action of the poison. But the plan of treatment most relied upon is that which is intended to produce a contrary physiological action. For this purpose *nicotia,* in doses of one minim, very cautiously repeated, and administered in warm wine or a little brandy and water, may be tried. In the absence of its active principle, tobacco itself may be used, half-an-ounce being boiled for a few seconds in half-a-pint of water, then carefully strained, the bulk being made up to a pint by the addition of cold water ; of this, wine-glassful doses may be given until the spasm is relieved, or until symptoms arise which indicate the danger of continuing its use. If there be much difficulty of swallowing, the infusion may be made stronger, and be given in smaller doses, or it may be administered by means of the stomach.pump, or as an enema. It is to be borne in mind, however, that nicotia is a deadly poison, and, therefore, it should be used with extreme caution, prompt measures, such as the administration of stimulants, being resorted to should any untoward effects supervene. *Conia* may be employed for a similar pur-

pose, and with the same precautions. More lately, chloral has been recommended as an antidote to strychnia, since strychnia has been found to be the best antidote to poisoning with chloral. But in all cases it is important to secure the ejection of as much of the poison as possible by means of an emetic or the stomach-pump, or both, if the first fails to act in a short time. Chloroform vapour may be employed to relieve the spasm, or the liquid itself, or other narcotics, may be given internally.

Nux vomica and its preparations, when given in small medicinal doses, repeated at regular intervals, act as tonics, and somewhat as diuretics, giving a generally improved tone to the entire system, increasing the flow of urine, and acting also slightly upon the bowels and upon the skin, as laxatives and diaphoretics. The appetite is at the same time improved. They also exercise a special stimulant action upon the medulla oblongata and spinal cord, producing spasmodic action of the voluntary muscles, without, as a rule, even in large doses, affecting the sensorium. In larger doses, they act more distinctly upon the muscular system, and also somewhat as topical irritants ; the stomach is disordered, the spirits are depressed, the patient becomes exceedingly sensitive to external impressions, complains of weariness, and sometimes a sense of creeping in his limbs, which sometimes tremble and sometimes feel stiff ; he has some difficulty in maintaining the upright position, and not unfrequently staggers in his gait. Convulsive spasms of the muscles from the most trivial impressions ensue if the drug be continued, and most of the muscles are implicated. At this stage of their action these preparations are said to be also aphrodisiacs. The pulse may be slightly increased in frequency, but is not uniformly so, and is often unaffected. At the same time, if any part of the body be paralysed, twitchings, which increase in frequency and power, may be observed in the paralysed muscles. In still larger doses these symptoms are intensified, spasm of the entire frame recurs at shorter and shorter intervals, the paroxysms becoming gradually more severe, until at length unmitigated tetanus takes possession of the patient, and he dies by asphyxia. Death has followed a dose of three grains of the extract, and in another case it was the consequence of thirty grains of the powder given to a girl of ten years of age, in two doses of fifteen grains each. Professor Christison mentions a case in which death ensued in fifteen minutes after taking the poison ; but more commonly the fatal result occurs between one and ten or twelve hours afterwards. Much depends upon the habits of the patient with respect to the drug, and the condition of the stomach with

respect to food, as to the effects to be produced and the period of their manifestation.

Nux vomica and its preparations, besides being employed in the treatment of paralysis, which will be mentioned with strychnia, are used in a variety of cases, chiefly as stomachics and tonics. They are given in affections of the stomach, such as atonic dyspepsia, pyrosis, gastrodynia, the vomiting of pregnancy, &c.; in affections of the bowels, such as diarrhœa, dysentery, painter's colic, flatulence, &c., forming an excellent adjunct to purgative pills used in flatulent constipation due to an *atonic* state of the bowels; in prolapsus of the rectum, in incontinence of urine, in chlorosis, hypochondriasis, amenorrhœa, neuralgia, in amaurosis, chorea, epilepsy, and many other conditions.

Strychnia and its salts act for the most part like nux vomica. When taken in poisonous doses, the symptoms which ensue are more or less as follows:—If taken in solution, it has an intensely bitter taste. After a certain interval, often without any warning, the victim suddenly feels a sense of suffocation, and the muscles of the head and limbs, if not of the entire body, are affected with tremblings and twitchings. In a little while longer tetanic convulsions seize almost the entire frame, and the body becomes rigidly fixed, with the head bent backwards, the body also arched backwards (opisthotonos), the hands clenched, the soles of the feet incurved, the face congested, and the expression of the countenance, caused by the spasmodic contraction of the muscles, that of the *sardonic grin.* There is heat and dryness of the fauces, and sometimes frothing at the mouth, with fixidity of the jaws, and an anxious feeling of impending suffocation. The intellect is generally but little, or not at all, affected during the intermissions; on the contrary, the external senses are usually exceedingly acute. The fits last from half-a-minute to two or more minutes, and recur at shorter and shorter intervals, and are longer continued towards the end. In the intervals the person feels exhausted, and terribly anxious; he generally knows when a paroxysm is coming on, and cries out either to be held, or that he will die. Very slight causes, such as the closing of a door, the rattling of articles upon the table, or lightly touching him, may produce a paroxysm; nevertheless, to be held firmly or to be rubbed is generally desired. Death either takes place by asphyxia during a paroxysm, or by exhaustion in the interval. One-sixteenth of a grain of strychnia, according to Dr Christison, killed a child, between two and three years of age, in

four hours; and Dr Warner, U.S., died in fourteen minutes, from the effects of half-a-grain of sulphate of strychnia. Half-a-grain of strychnia would be a dangerous dose for an adult, although some persons have recovered after taking three or more grains, and doses have frequently been increased to a grain without producing marked results. The period at which the symptoms supervene varies, but the effects of a poisonous dose are usually observed within from five to twenty minutes after taking it, and in fatal cases death generally occurs within two hours. Strychnia being thus a powerfully convulsant poison, it is astonishing to find, as has been lately discovered by the admirable experiments of Professor Crum Brown and Dr T. R. Fraser, that its methyl and ethyl compounds, while retaining most of their chemical properties, have their physiological actions completely changed, so that, instead of producing tetanic convulsions, like strychnia, they induce a condition of general paralysis of the body by paralysing the extremities of the motor nerves. These experimenters have also proved that the same is true of at least two other convulsant poisons, viz., brucia and thebaia. The change of physiological action is so absolute that Drs Brown and Fraser recommend the methyl and ethyl compounds of these poisons as antidotes in cases of poisoning with them. The substances experimented with were the iodide of methyl-strychnium, the sulphate of methyl-strychnium, and the nitrate and hydrochlorate of that base; also the iodide and sulphate of methyl-brucium, and the iodide and sulphate of methyl-thebaium.

Strychnia is employed in the cases already mentioned under nux vomica, but it is more commonly used in paralysis, and it is remarkable—and the cause of this has not been satisfactorily explained—that the muscular twitchings produced by it always begin in the paralysed part. Unless it be employed judiciously, strychnia may produce evil rather than good effects, for it is not in all cases of paralysis that its exhibition is indicated. It should not be given in cases in which the paralysis is due to an inflammatory condition of the brain or spinal cord, nor in those in which it is the consequence of the pressure of effused blood; and in those cases in which the paralysis is due to organic lesion of the nervous centres, it often does harm rather than good. It is not until inflammatory symptoms in the one case, and the effused blood in the other, have been removed, that strychnia produces its good effects in the removal of the paralysis, which is still apt to remain. It is more serviceable in general paralysis, and in paraplegia, than in hemiplegia; but it

often proves beneficial in the paralysis of certain organs, as of the bladder, the sphincter ani, and other parts, and in such cases it is sometimes better to apply it near the part, endermically or hypodermically, than to give it internally. It is useful in the treatment of local palsy, the result of lead or mercurial poisoning, or of rheumatism, and in those cases also its topical action is often to be preferred. In amaurosis, applied endermically, it is sometimes of advantage. In muscular tremors, nervous exhaustion, impotence, and other cases mentioned under nux vomica, strychnia may be cautiously tried.

Faba Sancti Ignatii are produced either by *Ignatia amara* or *Strychnos Ignatii. Woorali, Curara, Ourari,* or *Uirari* Poison is believed to be prepared from the juice of *Strychnos toxifera*. The doubts which were wont to be thrown upon the evidence tending to this conclusion are completely removed by the experiments of Drs Crum Brown and Fraser, which show that substances having diametrically opposite physiological properties may be very closely connected chemically. It is interesting to note, however, that these observers found in every instance that no curara was produced from the strychnia by their chemical manipulations. The bark of the root of *Strychnos Tieuté* supplies the Java poison called Upas Tieuté. These and other poisonous species contain strychnia.

Spigelia—Carolina Pink—Wormseed—Perennial Wormgrass.—The root of *Spigelia marilandica* was formerly officinal. It was used as an anthelmintic. In poisonous doses it is acro-narcotic, and in large doses acts as an irritant cathartic. Its use requires caution. *Dose* of the powdered root, ten to twenty grains to a child; sixty to one hundred and twenty grains to an adult. It may be given in the form of infusion.

GENTIANACEÆ—The Gentian Order.—Herbs, rarely shrubs, universally distributed. The plants are usually bitter; some have emetic and narcotic properties. Officinal plants: *Gentiana lutea, Ophelia Chirata.*

Gentianæ Radix—Gentian Root.—Officinal plant: *Gentiana lutea,* Linn.; *Pentandria Digynia;* Yellow Gentian. Illustration, plate 132, *Steph. and Church. Med. Bot.* Officinal part: The root, dried; collected in the Alps, Apennines, and other mountainous districts of Europe. Officinal preparations: *Extractum Gentianæ, Infusum Gentianæ, Compositum, Mistura Gentianæ.*

Botany.—Root, perennial, thick, fleshy, perpendicular, often bifurcated, brown externally, yellowish internally. *Stem,* simple, hollow, erect, two to three feet high. *Leaves,* sessile, ovato-acute, pale green. *Flowers,* in brilliant-yellow spikes. *Habitat,* central and southern Europe, at a considerable elevation above the level of the sea.

CHARACTERS OF THE ROOT.—*From half-an-inch to one inch in thickness, several inches in length, often twisted, much wrinkled, or marked with close transverse rings; brown externally, yellow within, tough and spongy; taste at first sweetish, afterwards very bitter.*

The root contains, besides other constituents, a volatile oil, a crystallisable, neutral, bitter principle, *Gentianin*, which is probably composed of *gentisic acid* or *gentisin* and *gentianite*. Other roots, some of which have poisonous properties, are occasionally mixed with gentian root.

EXTRACTUM GENTIANÆ—EXTRACT OF GENTIAN.—*Take of gentian root, sliced,* 1 *pound; boiling distilled water,* 1 *gallon. Infuse the gentian in the water for two hours; boil for fifteen minutes; pour off, press, and strain. Then evaporate the liquor, by a water-bath until the extract is of a suitable consistence for forming pills.*

INFUSUM GENTIANÆ COMPOSITUM—COMPOUND INFUSION OF GENTIAN.—*Take of gentian root, sliced; bitter orange peel, cut small, of each,* 60 *grains; fresh lemon peel, cut small,* ¼ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain.*

This is the Infusum Gentianæ Compositum, *Lond.* The preparation under this name in the *Brit. Pharm.*, 1864, is now named Mistura Gentianæ.

MISTURA GENTIANÆ—GENTIAN MIXTURE. *Synonym:* Infusum Gentianæ Compositum, 1864.—*Take of gentian root, sliced,* ¼ *ounce; bitter orange peel, cut small; coriander fruit, bruised, of each,* 30 *grains; proof spirit,* 2 *fluid ounces; distilled water,* 8 *fluid ounces. Macerate the gentian, orange peel, and coriander in the proof spirit for two hours, then add the water, macerate again for two hours, and strain through calico.*

TINCTURA GENTIANÆ COMPOSITA—COMPOUND TINCTURE OF GENTIAN.—*Take of gentian root, cut small and bruised,* 1½ *ounce; bitter-orange peel, cut small and bruised,* ¾ *ounce; cardamom seeds, freed from the pericarps and bruised,* ¼ *ounce; proof spirit,* 1 *pint. Macerate the solid ingredients for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of the extract, ten to thirty grains; of the compound infusion, one to two fluid ounces, of the mixture one-half to one fluid ounce, bearing in mind that it contains a considerable quantity of spirit; of compound tincture, half-a-fluid drachm to two fluid drachms. The preparations of gentian form suitable vehicles for iron and other metallic preparations.

Gentian acts as a purely bitter tonic. It is useful in atonic dyspepsia with acidity, and in a variety of cases associated with nervous debility, and inactivity of the digestive system. It is also somewhat anthelmintic, and in over-doses may act as a nauseant and laxative.

Chirata—Chiretta.—Officinal plants: *Ophelia Chirata*, DC.; *Tetrandria Monogynia;* the Chiretta or Chirayta. Illustration, pla t

252, vol. iii. *Wallich. Plant. Asiat.* (*Gentiana Chirata*). Officinal part: The entire plant; collected in northern India when the fruit begins to form. Officinal preparations: *Infusum Chiratæ, Tinctura Chiratæ.*

Botany.—Annual. *Stems,* about three feet high, smooth, round, branched. *Leaves,* opposite, amplexicaul, very acute. *Flowers,* in terminal panicles, yellow. *Habitat,* India.

Characters.—*Stems about three feet long, of the thickness of a goose-quill, round, smooth, pale-brown, branched; branches opposite; flowers small, numerous, panicled; the whole plant intensely bitter.*

The plant has a disagreeable, bitter, non-astringent, taste. It contains, with other constituents, a resin, and a yellow colouring matter.

INFUSUM CHIRATÆ—Infusion of Chiretta.—*Take of chiretta, cut small,* $\frac{1}{4}$ *ounce; distilled water at* 120°, 10 *fluid ounces. Infuse in a covered vessel for half-an-hour, and strain.*

TINCTURA CHIRATÆ — Tincture of Chiretta. — *Take of chiretta, cut small and bruised,* $2\frac{1}{2}$ *ounces; proof spirit,* 1 *pint. Macerate the chiretta for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of the spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of the infusion, half-a-fluid ounce to two fluid ounces; of the tincture, half-a-fluid drachm to two fluid drachms.

Chiretta acts as a bitter non-astringent tonic and stomachic. It is used in the same cases as gentian, to which it is closely allied in its medicinal properties.

Menyanthes—Buckbean or Marsh Trefoil.—The leaves of *Menyanthes trifoliata* were formerly officinal, and were used as a bitter tonic. *Dose.* —Of the powdered leaves, ten to twenty grains, or, much better, in the form of infusion.

CONVOLVULACEÆ—The Convolvulus Order.—Herbs or Shrubs, usually twining, chiefly inhabiting the tropics. The plants generally possess purgative properties. Officinal plants: *Convolvulus Scammonia, Exogonium Purga.*

Scammonium—Scammony.—Officinal plant: *Convolvulus Scammonia,* Linn.; *Pentandria Monogynia.* Illustration, plate 5, page 13, *Woodv. Med. Bot.* Officinal parts:—1. *Scammonii Radix.* The dried root; from Syria and Asia Minor. 2. *Scammonium,* Scammony; a gum-resin, obtained by incision from the living root in Syria. 3. *Scammoniæ Resina,* Resin of Scammony; a resin, obtained by means of rectified spirit, from scammony root or scammony. Officinal preparations: *Confectio Scammonii, Mistura Scammonii, Pulvis Scammonii Compositus;* it enters also into compound extract of colocynth, compound colocynth pill, and colocynth and hyoscyamus pill.

Botany.—A climbing plant. *Root,* perennial, tapering, three or four feet long, abounding in a milky juice. *Stems,* smooth, numerous, twining, herbaceous. *Leaves,* on long petioles, alternate, pointed. *Flowers,* either pale-yellow with purple stripes, or white with red stripes externally. *Habitat,* both on the mountains and in the plains, chiefly supported by the juniper and arbutus trees, in Anatolia, Syria, islands of the Grecian Archipelago, &c.

Characters of the Root.—*Tap-shaped roots, sometimes three inches in diameter at the top, brown without, white within, slightly odorous but tasteless. Ether agitated with the powder, and evaporated, leaves a residue having the properties of scammony resin.*

Characters of the Gum-Resin.—*Ash-grey and rough externally; fresh fracture resinous, splintery, shining, black when dry; odour and flavour cheesy; causes when chewed a slight prickly sensation in the back of the throat; easily triturated into a dirty-grey powder, and converted with water into a smooth emulsion.*

Purity Test.—*It does not effervesce with hydrochloric acid. Boiling water agitated with the powder, cooled and filtered, does not strike a blue colour with tincture of iodine. Ether removes from* 80 *to* 90 *per cent. of resin; and what remains is chiefly soluble gum, with a little moisture.*

Preparation of the Resin.—*Take of scammony root, in coarse powder,* 8 *ounces; rectified spirit, a sufficiency; distilled water, a sufficiency. Digest the scammony root with sixteen fluid ounces of the spirit in a covered vessel, at a gentle heat, for twenty-four hours; then transfer to a percolator, and when the tincture ceases to pass, add more spirit, and let it percolate slowly until the root is exhausted. Add to the tincture four fluid ounces of the water, and distil off the spirit by a water-bath. Remove the residue while hot to an open dish, and allow it to become cold. Pour off the supernatant fluid from the resin, wash this several times with hot water, and dry it on a porcelain plate with the heat of a stove or water-bath.*

Characters of the Resin.—*In brownish translucent pieces, brittle, resinous in fracture, of a sweet fragrant odour, if prepared from the root.*

Purity Tests.—*It cannot form singly an emulsion with water. Its tincture does not render the fresh-cut surface of a potato blue. Ether dissolves it entirely.*

It may also be prepared in a similar way from scammony.

The gum-resin may be obtained from the living root, and the resin may be obtained from the gum-resin, or it may be obtained directly from the dried root, which is now officinal. In order to obtain the gum-resin from the living roots, the earth is cleared away from their upper parts, and they are sliced obliquely about two inches below the point where the stalks spring off. Shells are stuck into the root at the lower part of the cut surface, and into these the milky juice flows. Scammony is collected during the summer months, and mussel shells are commonly used as receptacles for the juice. The juice flows into them in the morning and evening, but not during the heat of the day; each root scarcely fills one shell, but in exceptional cases one root may fill two or three. The gum-resin is next collected from the various shells, is mixed in copper vessels, and subsequently carefully dried. This is pure

scammony, but it rarely reaches this country in that state, being almost invariably adulterated, chiefly with wheat-flour, ashes, sand, &c. The scammony of commerce is usually imported from Smyrna, and occasionally from Trieste, in boxes or drums often lined with tin. *Pure* or *virgin scammony* should have the officinal characters. *Adulterated scammony,* called seconds and thirds, according to the amount of adulteration, generally occurs in roundish flattened cakes of different sizes. *Factitious scammony* consists of resins, gum, starch, &c., made to resemble as much as possible true scammony. From two specimens of old scammony, Professor Christison obtained respectively, 81·8 and 83 of resin, 6 and 8 of gum, 1 and 0 of starch, 3·5 and 3·2 of fibre and sand, and 7 and 7·2 of water. Scammony is very frequently adulterated ; the impurities more commonly met with are chalk, starch, flour, and guaiacum resin. The purity tests given with the characters will detect these ; namely, the chalk by effervescing with hydrochloric acid, the starch by the iodine test, and guaiacum resin by the potato test. The gum-resin should yield to ether from 80 to 90 per cent. of pure resin ; and the resin should be entirely soluble in ether, and be incapable of forming an emulsion with water, showing the absence of insoluble impurities and of gum.

CONFECTIO SCAMMONII—CONFECTION OF SCAMMONY.—*Take of scammony, in fine powder,* 3 *ounces ; ginger, in fine powder,* 1½ *ounce ; oil of caraway,* 1 *fluid drachm ; oil of cloves,* ½ *fluid drachm ; syrup,* 3 *fluid ounces ; clarified honey,* ½ *ounce. Rub the powders with the syrup and the honey into a uniform mass, then add the oils, and mix.*

MISTURA SCAMMONII—SCAMMONY MIXTURE.—*Take of resin of scammony,* 4 *grains ; milk,* 2 *fluid ounces. Triturate the resin of scammony with a little of the milk, and continue the trituration, gradually adding the remainder of the milk until a uniform emulsion is obtained.*

PULVIS SCAMMONII COMPOSITUS—COMPOUND POWDER OF SCAMMONY.—*Take of scammony, in powder,* 4 *ounces ; jalap, in powder,* 3 *ounces; ginger, in powder,* 1 *ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar.*

Dose.—Of powdered scammony (finely powdered, and mixed with gum, starch, sugar, or other bland powder, or in emulsion with milk, in order to obviate its irritant and griping properties), five to fifteen grains for an adult ; of the resin, two to five or ten grains, given in the same manner as the gum-resin ; of the confection, for a child, three to ten grains, for an adult, fifteen to thirty, forty, or more grains ; of the mixture, from half-a-fluid ounce to two fluid ounces ; of the compound powder, for a child, two to five grains, for an adult, ten to twenty grains.

Scammony acts as a drastic purgative, causing considerable local irritation in the bowels. It is useful as a derivative purgative in head cases, in dropsies, as a vermifuge, and as a brisk cathartic for children, either alone, or in combination with small doses of rhubarb or calomel. It is especially indicated in cases in which there is torpidity of the abdominal viscera, and is contra-indicated

in irritable and inflammatory conditions of the stomach and bowels. In large doses it may give rise to dangerous symptoms, or even prove fatal.

Jalapa—Jalap.—Officinal plant : *Exogonium Purga*, Bentham ; *Pentandria Monogynia ;* the Jalap Plant. Illustration, plate, 4280, vol. lxxv. *Bot. Mag.* Officinal parts :—1. The tubers dried ; imported from Mexico. 2. *Jalapæ Resina,* Resin of Jalap ; a resin obtained from Jalap by means of rectified spirit. Officinal preparations :—*Extractum Jalapæ, Pulvis Jalapæ Compositus, Resina Jalapæ, Tinctura Jalapæ.*

Botany.—*Root,* perennial, tuberous, fleshy, having numerous pear-shaped tubers. *Stems,* annual, herbaceous, smooth, climbing to a considerable height. *Leaves,* alternate, cordiform, with leaf stalk. *Flowers,* one to three, large ; corolla campanulate, large, reddish-purple in the centre, and elsewhere whitish. *Habitat,* winding round the larger trees of the forests near Xalapa, on the eastern slopes of the Mexican Andes, from four to six thousand feet above the level of the sea.

Characters of the Tubers.—*Varying from the size of a nut to that of an orange, ovoid, the larger tubers frequently incised, covered with a thin brown wrinkled cuticle ; presenting, when cut, a yellowish-grey colour, with dark-brown concentric circles.*

Preparation of the Resin.—*Take of jalap, in coarse powder,* 8 *ounces ; rectified spirit, a sufficiency; distilled water, a sufficiency. Digest the jalap with sixteen fluid ounces of the spirit in a covered vessel, at a gentle heat, for twenty-four hours ; then transfer to a percolator, and when the tincture ceases to pass, continue the percolation with successive portions of spirit until it ceases to dissolve anything more. Add to the tincture four fluid ounces of the water, and distil off the spirit by a water-bath. Remove the residue, while hot, to an open dish, and allow it to become cold. Pour off the supernatant fluid from the resin, wash this two or three times with hot water, and dry it on a procelain plate by the heat of a stove or water-bath.*

Characters of the Resin.—*In dark-brown opaque fragments, translucent at the edges, brittle, breaking with a resinous fracture, readily reduced to a pale brown powder, sweetish in odour, acrid in the throat, easily soluble in rectified spirit, but only partially so in ether, and insoluble in oil of turpentine.*

Jalap root is dug up when the young shoots begin to appear, and is dried by exposure to the atmosphere, suspended in bags, or by the aid of fire heat. The dried tubers of commerce rarely exceed one pound in weight ; they are ovoid, and vary in size from that of a nut to that of the clenched fist. They are covered with a thin brown wrinkled cuticle, presenting, when freshly broken, a yellowish-grey colour, with deep brown concentric circles. They are often imported in slices of various sizes, having been cut to facilitate the drying. The pieces are often worm-eaten, and these are the best, for the worms eat the starch only, leaving the active principle untouched, and therefore, weight for weight, the worm-eaten pieces are medicinally stronger. Spurious varieties, such as the Mexico male jalap, and the false rose-scented jalap, are sometimes mixed with the true kind. The root contains, beside other constituents,

resin, which may be separated by solution in rectified spirit, bitter extractive, gummy extract, starch, albumen, &c. The resin is the active purgative principle, and consists of two distinct varieties, one soluble in ether, the other insoluble.

EXTRACTUM JALAPÆ—Extract of Jalap.—*Take of jalap, in coarse powder,* 1 *pound; rectified spirit,* 4 *pints; distilled water,* 1 *gallon. Macerate the jalap in the spirit for seven days; press out the tincture, then filter, and distil off the spirit, leaving a soft extract. Again macerate the residual jalap in the water for four hours, express, strain through flannel, and evaporate by a water-bath to a soft extract. Mix the two extracts, and evaporate at a temperature not exceeding* 140°, *until it has acquired a suitable consistence for forming pills.*

PULVIS JALAPÆ COMPOSITUS — Compound Powder of Jalap.—*Take of jalap, in powder,* 5 *ounces; acid tartrate of potash,* 9 *ounces; ginger, in powder,* 1 *ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar.*

TINCTURA JALAPÆ—Tincture of Jalap.—*Take of jalap, in coarse powder,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the jalap for forty-eight hours in fifteen fluid ounces of the spirit in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of powdered jalap, two to ten grains for a child, ten to thirty grains for an adult; of the resin, one to five or six grains, mixed with a bland powder to prevent irritation and griping; of the extract, which contains both the resin and the gummy extractive, the former separated by the spirit, the latter by the water, five to twenty grains; of the compound powder, fifteen to forty or fifty grains; of the tincture, half-a-fluid drachm to two fluid drachms.

Jalap acts as a powerful drastic purgative, producing copious liquid evacuations, and occasionally causing nausea and griping. It is usually a safe medicine for children, but in over-doses may give rise to excessive purging and inflammation. It is given to overcome habitual constipation, as a hydragogue in dropsies, as an anthelmintic, as a derivative purgative in head affections, &c. It is useful also as a purgative in febrile and inflammatory affections, as it causes neither vascular excitement nor constitutional disturbance.

SOLANACEÆ—The Potato Order.—Herbs or shrubs, widely distributed, but abounding within the tropics. The order furnishes edible tubers and fruit, and medicines which are characterised by tonic, pungent, or stimulant properties. Officinal plants: *Capsicum fastigiatum, Solanum Dulcamara.*

Capsicum — Capsicum. — Officinal plant: *Capsicum fastigiatum*, Blume, Bijdr.; *Pentandria Monogynia.* Illustration, plate 1617, vol. iv., *Wight, Icones Plant. Ind. Orient.* Officinal part: *Capsici Fructus*, the ripe fruit dried; imported from the coast of Guinea, and from the East and West Indies, and distinguished in commerce as Guinea Pepper and Pod Pepper. Officinal preparation: *Tinctura Capsici.*

Botany.—A small branched shrub, one to two feet high, with ovate smooth leaves on long footstalks. *Flowers*, solitary, axillary, white. *Capsule*, oblong, cylindrical, straight, deep-red, and very pungent when ripe. *Habitat*, Sierra Leone.

CHARACTERS.—*Pod membranous, from five to eight lines long, two lines broad, straight, conical, pointed, smooth, shining, but somewhat corrugated, orange-red, intensely hot in taste.*

Cayenne pepper is met with as a reddish powder, which has an intensely acrid burning taste, dependent upon an active solid oil termed Capsicin.

TINCTURA CAPSICI—TINCTURE OF CAPSICUM.—*Take of Capsicum fruit, bruised, ¾ ounce; rectified spirit, 1 pint. Macerate the capsicum for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.*

Dose.—Of the powder, one to five grains; of the tincture, five to fifteen minims.

Capsicum acts as an acrid stimulant in moderate doses, and as an irritant poison in over-doses. Externally it acts as a rubefacient. It is largely used as a condiment, and, as a medicine, is employed chiefly for the sake of its local stimulant action upon the mucous membrane of the mouth, throat, and stomach. It may be given in atonic dyspepsia, and in all cases in which it is desirable promptly to arouse the stomach from a feeble or sluggish condition. The tincture is used as an adjunct to gargles in relaxed or putrid sore throat.

Dulcamara — Dulcamara — Officinal plant: *Solanum Dulcamara*, Linn.; *Pentandria Monogynia;* Bittersweet. Illustration, plate 14, fasc. i., *Flor. Lond.* Officinal part: The young branches dried; from indigenous plants which have shed their leaves. Officinal preparation: *Infusum Dulcamaræ.*

Botany.—Root, woody. *Stem*, shrubby, twining, flexible. *Leaves*, acute, generally smooth, entire at the margins, the lower ones cordate, the upper hastate. *Inflorescence*, racemose; corolla purple, with two green spots at the base of each segment, of which there are five. *Fruit*, a scarlet berry, juicy and many-seeded. *Habitat*, indigenous; in hedgerows and woods in this and other European countries.

CHARACTERS OF THE YOUNG BRANCHES.—*Light, hollow, cylindrical, about the thickness of a goose-quill, bitter, and subsequently sweetish, to the taste.*

The plant contains an alkaloid, *Solania,* which is probably poisonous, acting as an acro-narcotic.

INFUSUM DULCAMARÆ—INFUSION OF DULCAMARA.—*Take of dulcamara, bruised,* 1 *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vesssel for one hour, and strain.*

Dose.—Of the infusion, one to three or four fluid ounces.

Dulcamara is said to act as a diaphoretic, diuretic, demulcent, and alterative, and in over-doses as an acro-narcotic. It has been used in a variety of cases, the decoction forming a convenient vehicle for other medicines, as in chronic pulmonary complaints, in chronic cutaneous diseases, &c.

ATROPACEÆ—The Deadly Nightshade Order.—Closely allied to the Solanaceæ. The plants of this order are in general narcotic poisons. Officinal plants: *Atropa Belladonna, Datura Stramonium, Hyoscyamus niger, Nicotiana Tabacum.*

Belladonna—Belladonna.—Officinal plant: *Atropa Belladonna,* Linn.; *Pentandria Monogynia;* Deadly Nightshade. Illustration, plate 16, fasc. v., *Flor. Lond.* Officinal parts: 1. *Belladonnæ Folia*—Belladonna leaves, fresh and dried, and the fresh branches, gathered, when the fruit has begun to form, from wild or cultivated plants in Britain. 2. *Belladonnæ Radix*—Belladonna Root: The root dried; imported from Germany. 3. *Atropia,* an alkaloid, $C_{17}H_{23}NO_3$, obtained from Belladonna root. Officinal preparations: *Emplastrum Belladonnæ, Extractum Belladonnæ, Linimentum Belladonnæ, Tinctura Belladonnæ, Unguentum Belladonnæ, Liquor Atropiæ, Sulphas Atropiæ, Liquor Atropiæ Sulphatis, Unguentum Atropiæ.*

Botany.—*Root,* perennial, thick, fleshy, branched, often a foot or more in length. *Stems,* herbaceous, annual, three to five feet high, branched, downy, of a reddish tinge. *Leaves,* alternate, four or five inches long, often in pairs of unequal size, broadly ovate, acute. *Flowers,* solitary, stalked, drooping, about one inch in length; corolla campanulate, greenish towards the base, but dark-purple towards the extremity. *Berry,* of a shining violet-black colour, two-celled, about the size of a small cherry, and contains numerous reniform seeds embedded in a mawkish pulp. *Habitat,* indigenous; growing in waste and shady places. It flowers in June and July, and the berries ripen in September.

CHARACTERS.—*Leaves alternate, three to six inches long, ovate, acute, entire, smooth, the uppermost in pairs, and unequal. The expressed juice or an infusion, dropped into the eye, dilates the pupil.*

CHARACTERS OF THE ROOT.—*From one to two feet long, and from half-an-inch to two inches thick, branched and wrinkled, brownish-white. An infusion dropped into the eye dilates the pupil.*

The leaves are of a dull green colour; those of the wild plant are more esteemed than the leaves of the cultivated plant, and they are said to possess their active principle most abundantly when the fruit has just begun to form; they have a disagreeable taste, and a peculiar and somewhat fetid odour when bruised. Sometimes the leaves of *Solanum Dulcamara* or those of *Solanum nigrum* are substituted for the true belladonna leaves. The fresh root is fleshy, has a feeble odour, a sweetish taste, is brownish-white externally, and white internally. The active principle of the plant is the alkaloid *Atropia.*

EMPLASTRUM BELLADONNÆ—Belladonna Plaster—*Take of extract of belladonna; resin plaster, of each,* 3 *ounces; rectified spirit,* 6 *fluid ounces. Rub the extract and spirit together in a mortar, and when the insoluble matter has subsided, decant the clear solution, remove the spirit by distillation or evaporation, and mix the alcoholic extract thus obtained with the resin plaster melted by the heat of a water-bath, continuing the heat until with constant stirring the plaster has acquired a suitable consistence.*

EXTRACTUM BELLADONNÆ—Extract of Belladonna.—*Take of the fresh leaves and young branches of belladonna,* 112 *pounds. Bruise in a stone mortar, and press out the juice; heat it gradually to* 130°, *and separate the green colouring matter by a calico filter. Heat the strained liquor to* 200° *to coagulate the albumen, and again filter. Evaporate the filtrate by a water-bath to the consistence of a thin syrup; then add to it the green colouring matter previously separated, and, stirring the whole together assiduously, continue the evaporation at a temperature not exceeding* 140°, *until the extract is of a suitable consistence for forming pills.*

LINIMENTUM BELLADONNÆ—Liniment of Belladonna.—*Take of belladonna root, in coarse powder,* 20 *ounces; camphor,* 1 *ounce; rectified spirit, a sufficiency. Moisten the belladonna with some of the spirit, and macerate in a closed vessel for three days; then transfer to a percolator, and, adding more spirit, percolate slowly into a receiver containing the camphor, until the product measures one pint.*

TINCTURA BELLADONNÆ—Tincture of Belladonna.—*Take of belladonna leaves, in coarse powder,* 1 *ounce; proof spirit,* 1 *pint. Macerate the leaves for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

UNGUENTUM BELLADONNÆ—Ointment of Belladonna.—*Take of extract of belladonna,* 80 *grains; prepared lard,* 1 *ounce. Rub the extract smooth with a few drops of distilled water, then add the lard, and mix thoroughly.*

Atropia—Atropia.—An alkaloid ($C_{34}H_{23}NO_6$, or $C_{17}H_{23}NO_3$) obtained from belladonna root.

Preparation.—*Take of belladonna root, recently dried, and in coarse*

powder, 2 *pounds; rectified spirit,* 10 *pints; slaked lime,* 1 *ounce; diluted sulphuric acid; carbonate of potash, of each, a sufficiency; chloroform,* 3 *fluid ounces; purified animal charcoal, a sufficiency; distilled water,* 10 *fluid ounces. Macerate the root in four pints of the spirit for twenty-four hours, with frequent stirring. Transfer to a displacement apparatus, and exhaust the root with the remainder of the spirit by slow percolation. Add the lime to the tincture placed in a bottle, and shake them occasionally several times. Filter, add the diluted sulphuric acid in very feeble excess to the filtrate, and filter again. Distil off three-fourths of the spirit, add to the residue the distilled water, evaporate at a gentle heat, but as rapidly as possible, until the liquor is reduced to one-third of its volume, and no longer smells of alcohol; then let it cool. Add very cautiously, with constant stirring, a solution of the carbonate of potash, so as nearly to neutralise the acid, care, however, being taken that an excess is not used. Set to rest for six hours, then filter, and add carbonate of potash in such quantity that the liquid shall acquire a decided alkaline reaction. Place it in a bottle with the chloroform; mix well by frequently repeated brisk agitation, and pour the mixed liquids into a funnel furnished with a glass stopcock. When the chloroform has subsided, draw it off by the stopcock, and distil it on a water-bath from a retort connected with a condenser. Dissolve the residue in warm rectified spirit; digest the solution with a little animal charcoal; filter, evaporate, and cool until colourless crystals are obtained.*

Rationale.—The spirit removes the atropia in the form of malates, as it exists in the plant, and along with these salts, colouring matter, &c. When the lime is added, it abstracts the malic acid, leaving the atropia free in solution. The precipitated lime salts are then removed by filtration. The sulphuric acid converts the atropia into the sulphate, and the second filtration removes any adherent salt of lime. Carbonate of potash is then very cautiously added in order to remove a resinous substance which is associated with the sulphate of atropia in solution, and which, if not removed, would interfere with the subsequent crystallisation. This substance is removed by filtration. In the next place, the alkaloid is precipitated by an excess of carbonate of potash, and is then dissolved out by means of the chloroform. Lastly, the chloroform is removed by distillation, the residual alkaloid is dissolved in spirit, purified by digestion with animal charcoal and filtration, and crystallised by evaporation.

CHARACTERS OF ATROPIA.—*In colourless acicular crystals, sparingly soluble in water, more readily in alcohol and in ether. Its solution in water has an alkaline reaction, gives a citron-yellow precipitate with terchloride of gold, has a bitter taste, and powerfully dilates the pupil. It is an active poison.*

PURITY TESTS.—*Leaves no ash when burned with free access of air.*

Atropia crystallises in white transparent silky prisms, or in acicular crystals, according to the solution from which it is crystallised, and it also occurs in vitreous masses. It is inodorous, has a bitter, acrid, and rather metallic taste. It dissolves freely in chloroform and in alcohol, and also in ether, but very sparingly in water. Its salts are soluble in water, but are very unstable, being gradually decomposed by exposure to the air.

LIQUOR ATROPIÆ—SOLUTION OF ATROPIA.—*Take of atropia,* 4 *grains; rectified spirit,* 1 *fluid drachm; distilled water,* 7 *fluid drachms. Dissolve the atropia in the spirit, and add this gradually to the water, shaking them together.*

ATROPIÆ SULPHAS—SULPHATE OF ATROPIA.—*Take of atropia,* 120 *grains; distilled water,* 4 *fluid drachms; diluted sulphuric acid, a sufficiency. Mix the atropia with the water, and add the acid gradually, stirring them together until the alkaloid is dissolved and the solution is neutral. Evaporate it to dryness at a temperature not exceeding* 100°.

CHARACTERS AND TESTS.—*A colourless powder, soluble in water, forming a solution which is neutral to test paper, and when applied to the eye dilates the pupil, as the solution of atropia does. It leaves no ash when burned with free access of air.*

Intended for external application. It is a powerful poison.

LIQUOR ATROPIÆ SULPHATIS—SOLUTION OF SULPHATE OF ATROPIA.—*Take of sulphate of atropia,* 4 *grains; distilled water,* 1 *fluid ounce. Dissolve.*

UNGUENTUM ATROPIÆ—OINTMENT OF ATROPIA.—*Take of atropia,* 8 *grains; rectified spirit,* ½ *fluid drachm; prepared lard,* 1 *ounce. Dissolve the atropia in the spirit, add the lard, and mix thoroughly.*

Dose.—Of the powdered leaves, for a child, from one-eighth to one-third of a grain; for an adult, one grain, cautiously increased until dryness of the throat, dilatation of the pupil, or other symptom is produced, but the tincture and extract are more commonly employed. Of the extract, half-a-grain, cautiously increased to two or three grains. Of the tincture, ten to thirty minims. *Emplastrum Belladonnæ* is used as a local application to allay pain, as in neuralgia, rheumatism, &c.; it is applied to the sacrum to afford relief in dysmenorrhœa, and over the cardiac region for the relief of angina and palpitation. *Linimentum Belladonnæ* is very much stronger than the tincture; as it contains no oleaginous ingredient, it is to be applied by means of a camel's-hair brush, unless it be added to a true liniment, and thus be rendered applicable by friction. *Unguentum Belladonnæ* may be applied to relieve pain in cases in which it is a more convenient form than the two preceding preparations.

Atropia and its sulphate are very rarely given internally; the dose would be from one-thirtieth of a grain, cautiously increased. *Liquor Atropiæ* and *Liquor Atropiæ Sulphatis* are rarely given internally; dose, two to four or more minims, cautiously increased, diluted with four times the quantity of water. It is, however, quite common to introduce both the *Liquor Atropiæ* and the *Liquor Atropiæ Sulphatis* hypodermically, whether with a view to bring the system under the influence of atropia, or to combat local pain. The *Liquor Atropiæ Sulphatis* is generally believed to be less irritating when introduced into the cellular tissue than the simple *Liquor Atropiæ.* Two to four minims of either, suitably diluted, form usually a proper quantity for injection. Caution is required not to rashly employ too strong a dose, as atropia is known to act more powerfully so administered than when introduced by the mouth. They are used to dilate the pupil by placing a drop upon the eye. *Unguentum*

Atropiæ may be applied round the eyelids to dilate the pupil, and for other purposes, as a substitute for the external application of extract or ointment of belladonna, care being taken to avoid broken surfaces. *Atropine paper* and *atropised gelatine* are now commonly employed for dilating the pupil. The leaves may be applied in the form of fomentation or cataplasm to relieve pain.

Antidotes.—Empty the stomach by means of a stimulating emetic, such as sulphate of zinc or sulphate of copper ; vegetable acids have been recommended ; substances containing tannin, such as tea or infusion of galls, have been used ; alkalies, especially liquor potassæ, interfere with its action as observed upon the pupil, the latter, therefore, may be administered. But the more recent plan of treatment is to endeavour to set up an antagonistic physiological action by means of opium or Calabar bean, the dose being in accordance with the age and condition of the patient. The effects produced by belladonna or atropia upon the pupil may be counteracted by means of Calabarised gelatine, or other preparation of the Calabar bean. Diffusible stimulants and other treatment according to circumstances.

Belladonna belongs to the class of deliriant narcotics, in common with henbane, stramonium, &c. In over-doses it is poisonous, producing, more or less, the following symptoms :—An unpleasant metallic taste in the mouth, hoarseness of voice, and dryness of the mouth and throat, complete or partial aphonia, ineffectual attempts at vomiting, excessive dilatation of the pupils, vision variously affected, but always more or less impaired, eyes suffused, face benumbed, singing in the ears or other noises in the head ; deglutition is difficult, or impossible ; pulse is very much accelerated (often 50 to 60 beats per minute) ; palpitation of the heart, weakness of the limbs, tendency to syncope, giddiness, great general excitement, and a disposition to fight, laugh, or talk ; inability to control the movements of the muscles by any effort of the will, catching at imaginary objects in the air, incoherent replies to questions, &c. The saliva is diminished, but the secretions of the skin, mucous membranes, and kidneys are increased. This stage is followed by a condition of coma, which may end in death. The pulse, in fatal cases, gets more and more rapid, intermittent, and weak. Recovery is ushered in by a repetition of the symptoms of mirthful delirium. There is sometimes an eruption upon the skin resembling that of scarlatina ; strangury is occasionally observed. The characterising symptoms are dryness of the throat, dilatation of the pupil, perversion of vision, and mirthful delirium. Recovery is gradual, and the patient has no recollection of his previous condition ; the pupil is slowly restored, and there remains marked nervous depression for a considerable time. Poisoning not unfrequently occurs from eating

the berries, plucked from the plant in ignorance of their action. In September 1865 a man, with well-marked symptoms of belladonna poisoning, was brought under my care in the Infirmary, after having eaten only seven of the berries.

Medicinally, belladonna is employed as an anodyne, hypnotic, antispasmodic, mydriatic, diuretic, and stimulant.

As an *anodyne* in local nervous pains, such as tic douloureux, prosopalgia, cardiac neuralgia, pain from inflammatory swelling, to relieve the pain resulting from the pressure of internal aneurism, in intercostal neuralgia, in lumbago, myalgia, orchitis, and chordee, dysmenorrhœa, irritable uterus, uterine cancer, &c.; in incontinence of urine due to hyperæsthesia of the bladder. For its full anodyne effects, the local application of the medicine should be combined with its internal administration.

As an *hypnotic*, it may be employed as a substitute for opium, but it is not nearly so certain in its action. Dr John Harley asserts that, given in combination with opium or morphia, it greatly enhances the hypnotic effects of the opiate, while it diminishes the disagreeable after effects.

As an *antispasmodic* in whooping-cough, laryngismus stridulus, and in spasmodic coughs generally, in epilepsy and chorea, in spasmodic stricture of the urethra, in rigidity of the cervix uteri, in spasm of the sphincter ani, in certain cases of incontinence of urine, in chordee, to correct the griping of various medicines, in habitual constipation, &c.

As a *mydriatic*, it is employed in ophthalmic surgery to dilate the pupil, and thus either prevent the formation of iridal adhesions, tear them asunder if they have formed, allow of the safer performance of certain operations upon the eye, or aid investigation into its cavity. How it dilates the pupil is still doubtful. Some hold that it directly paralyses the muscles of the iris; others, that it paralyses the branches of the third nerve distributed to the circulating fibres of the iris; some, again, that it stimulates the sympathetic branches supplying its radiating fibres; and, lastly, others maintain that it acts by merely preventing turgescence of the vessels of the iris. But in whatever way we may explain its action, belladonna is practically of the greatest value to the ophthalmic surgeon. Besides dilating the pupil, the extract of belladonna, when smeared over the eyebrow, at the same time greatly diminishes the browache so frequently attendant upon inflamed conditions of the eye.

As a *diuretic*, it is possessed of considerable reputation, and is

strongly recommended by Dr John Harley, who gives a large number of cases in evidence of this action of belladonna. He shows that the elimination of atropia by the kidneys commences the minute it is injected through the skin, and that in two and a-half hours afterwards none is left; that, besides the fluid constituents of the urine, it increases the amount of urea excreted, notably so of the phosphates and sulphates, and somewhat diminishes the chlorides. He found it beneficial in acute nephritis, in chronic albuminuria (provided the degeneration of the kidney is not the fatty variety), and recommends it as likely to be beneficial in suppression of urine and in uræmia. In acting as a diuretic, Dr Harley believes it does so as a stimulant to the sympathetic nerve-centres of the kidneys.

As a *vasculo-cardiac stimulant.* The admirable researches of Dr John Harley have proved that this is the primary and most essential effect of belladonna, and that it has no direct power of diminishing the vascularity of the nerve-centres, as Brown-Sequard maintained, but, acting through the sympathetic system, stimulates the circulation generally, and that it is only by increasing the activity of the vascular walls and of the circulation throughout the various nerve-centres that it appears to diminish their vascularity, though at the same time it increases the amount of blood circulating through the part in a given time. As a vasculo-cardiac stimulant, Dr Harley recommends it in all diseased conditions in which there is depression of the sympathetic nerve-force, as in syncope from asthenia and from shock, in the collapse of cholera, in failure of the heart's action from chloroform and other cardiac paralysers (atropia being introduced subcutaneously); in pneumonia, in depressed conditions occurring during the course of continued fever, &c. Care must always be taken not to administer too large a dose, lest the stage of stimulation pass into that of depression.

Belladonna possesses remarkably the power of preventing the secretion of milk, and an excellent lactifuge application is to cover the mamma with a belladonna plaster. It is also generally believed to be useful in those cases of excessive salivary secretion which occasionally occur during pregnancy. In paralytic conditions, when we have evidence of hyperæmia of the cord or its membranes, it is of the greatest value. It has been supposed prophylactic against scarlet fever, but there is the best reason to believe that this is an opinion unfounded on fact.

Stramonium—Stramonium.—Officinal plant: *Datura Stramonium*, Linn.; *Pentandria Mongynia;* Thorn-Apple. Illustration, plate 124

Woodv. Med. Bot. Officinal parts :—1. *Stramonii Folia,* Stramonium Leaves—the leaves dried ; collected from plants cultivated in Britain, when they are in flower. 2. *Stramonii Semina,* Stramonium Seeds, the ripe seeds. Officinal preparations : *Extractum Stramonii, Tinctura Stramonii.*

Botany.—An indigenous herbaceous annual, growing in waste places and on dunghills. *Root,* large, white, fibrous. *Stems,* much branched, smooth, fetid. *Leaves,* large, unequal at the base, ovate, unequally sinuate-dentate. *Flowers,* axillary, erect, white, giving off an agreeable odour, especially at night. Flowers in July.

CHARACTERS OF THE LEAVES.—*Large, ovate, sinuous, deeply cut ; of a heavy odour, which is strongest while they are drying, and of a mawkish faintly-bitter nauseous taste.*

CHARACTERS OF THE SEEDS.—*Brownish-black, reniform, flat, rough, in taste feebly bitter and mawkish ; inodorous, unless bruised, when they emit a peculiar heavy smell.*

The plant owes its medicinal properties to an alkaloid, *Daturia,* which may be obtained in colourless prismatic crystals. It resembles atropia.

EXTRACTUM STRAMONII—EXTRACT OF STRAMONIUM.—*Take of stramonium seeds, in coarse powder,* 1 *pound ; ether,* 1 *pint, or a sufficiency ; distilled water ; proof spirit, of each, a sufficiency. Shake the ether in a bottle with half-a-pint of the water, and after separation decant the ether. Pack the stramonium in a percolator, and free it from its oil by passing the washed ether slowly through it. Having removed and rejected the ethereal solution, pour the spirit over the residue of the stramonium in the percolator, and allow it to pass through slowly until the powder is exhausted. Distil off most of the spirit from the tincture, and evaporate the residue by a water-bath until the extract has acquired a suitable consistence for forming pills.*

TINCTURA STRAMONII—TINCTURE OF STRAMONIUM.—*Take of stramonium seeds, bruised,* 2½ *ounces ; proof spirit,* 1 *pint. Macerate the stramonium for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally ; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of the powdered herb or leaves, one to three or four grains ; of the seeds, a quarter of a grain, cautiously increased to a grain ; of the extract, an eighth of a grain, cautiously increased to half-a-grain ; of the tincture, ten to twenty minims. The effects of the medicine must be carefully watched, so as to stop its administration as soon as they become obvious. Ten to twenty grains of the herb may be smoked in a pipe or cigar ; but it must be very carefully used ; it should be immediately discontinued if vertigo or dryness of the throat supervenes.

Antidotes.—Same as in poisoning by belladonna.

Stramonium acts as a narcotic, anodyne, and antispasmodic, and in over-doses produces poisonous symptoms resembling those which follow an over-dose of belladonna. It has been employed to relieve

pain in neuralgic, rheumatic, and other painful affections, to relieve spasm, especially in spasmodic asthma, for the relief of which it may be cautiously smoked; in epilepsy, chorea, &c., being used internally for the same purposes as belladonna.

Hyoscyami Folia—Hyoscyamus Leaves.—Officinal plant: *Hyoscyamus niger*, Linn.; *Pentandria Monogynia*, Henbane. Illustration, plate 9, *Steph. and Church Med. Bot.* The fresh leaves with the branches of the indigenous biennial plant dried; collected when about two-thirds of the flowers are expanded. Officinal preparations: *Extractum Hyoscyami*, *Tinctura Hyoscyami.*

Botany.—The plant is usually biennial, but under favourable circumstances it is annual. *Root*, spindle-shaped. *Stem*, is usually simple, or but little branched, hirsute, one to three feet high. *Leaves*, large, dull green, unequally sinuate, downy, clammy, and have a fetid odour; the radicle leaves only appear in the first year, and the other leaves with the stems appear in the following spring. *Flowers*, numerous, unilateral, drooping, nearly sessile; corolla and calyx, funnel-shaped; corolla, dull straw-colour reticulated with dark purple veins. *Fruit*, capsular, with small roundish yellowish-grey and finely dotted seeds. The biennials flower in June, the annuals a little later; seeds ripen from August to October. *Habitat*, indigenous, waste places and commons.

CHARACTERS.—*Leaves sinuated, clammy, and hairy. The fresh herb has a strong unpleasant odour, and a slightly acrid taste, which nearly disappear on drying. The fresh juice dropped into the eye dilates the pupil.*

The plant contains an alkaloid, *Hyoscyamia*, which closely resembles atropia.

EXTRACTUM HYOSCYAMI—EXTRACT OF HYOSCYAMUS.—*Take of the fresh leaves and young branches of hyoscyamus*, 112 *pounds. Bruise in a stone mortar, and press out the juice; heat it gradually to* 130°, *and separate the green colouring matter by a calico filter. Heat the strained liquor to* 200° *to coagulate the albumen, and again filter. Evaporate the filtrate by a water-bath to the consistence of a thin syrup; then add to it the green colouring matter previously separated, and, stirring the whole assiduously, continue the evaporation at a temperature not exceeding* 140°, *until the extract is of a suitable consistence for forming pills.*

Enters into the preparation of *Pilula Colocynthidis et Hyoscyami.*

TINCTURA HYOSCYAMI—TINCTURE OF HYOSCYAMUS.—*Take of hyoscyamus leaves, in coarse powder*, 2½ *ounces; proof spirit*, 1 *pint. Macerate the hyoscyamus for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of the powdered leaves, five to ten grains; of the seeds, two to eight or ten grains; of the extract, two to ten or more grains; of the tincture, thirty minims to two fluid drachms.

Antidotes.—Empty the stomach promptly by stimulant emetics, or the stomach-pump, followed by a cathartic ; stimulants, and other treatment according to circumstances.

Henbane is very similar to belladonna in its actions, only the primary stimulant effects on the pulse are not so well marked. It is intermediate in action between opium and belladonna ; is allied to opium in being more somniferous than belladonna; but, on the other hand, it causes the symptoms of delirium which belladonna produces in a more marked degree. It differs, moreover, from opium in not causing constipation, and not checking secretions, and in causing dilation, and never contraction, of the pulse. From belladonna and stramonium it also differs in not producing dryness and irritation of the mucous membrane, and the delirium which follows large doses is more frequently furious than mirthful. Poisonous doses are followed by dilatation of the pupil and disturbance of vision, mirthful or furious delirium, coma; sometimes nausea, vomiting, and purging ; the face is often distorted, and there is ultimately more or less of paralysis with occasional convulsive movements. In small and repeated doses it acts as a calmative, tranquillising the patient, and allaying general and local nervous irritability and excitement, producing sleep rather by its soothing influence than by any direct action upon the nervous system. It is employed as a calmative and sedative in a variety of cases, and also to relieve pain and procure sleep. It may be given as a substitute for opium in cases in which the latter is an objectionable remedy. It is occasionally also used as an antispasmodic, but is inferior to belladonna and stramonium. Topically, by fomentation or cataplasm, or by the application of the extract, it may be used as an anodyne to painful swellings, hæmorrhoids, neuralgic and rheumatic pains, &c., but is often unavailing. It is frequently combined with purgatives to correct their irritating and griping qualities. It may be given in moderate doses to children to allay the irritation produced by teething, when there is a tendency to convulsions, &c.

Tabaci Folia—Leaf Tobacco.—Officinal plant : *Nicotiana Tabacum,* Linn. ; *Pentandria Monogynia ;* Virginian Tobacco. Illustration, plate 37, *Steph. and Church. Med. Bot.* The dried leaves ; cultivated in America. Officinal preparation : *Enema Tabaci.*

Botany.—A viscid herb. *Root,* branched and fibrous. *Stem,* herbaceous, three to six feet high, erect, round, hairy, and branching at the top. *Leaves,* sessile, pale green, large, oblong-lanceolate, acuminate. *Flowers,* in terminal panicles, corolla funnel-shaped and rose-coloured. *Fruit,* capsular, containing numerous reniform brownish seeds. *Habitat,* United States, chiefly in Virginia ; cultivated in many parts of the world.

CHARACTERS.—*Large, mottled-brown, ovate or lanceolate acuminate leaves, bearing numerous short, glandular hairs; having a peculiar heavy odour, and nauseous, bitter, acrid taste; yielding, when distilled with solution of potash, an alkaline fluid, which has the peculiar odour of nicotia, and precipitates with perchloride of platinum and tincture of galls.* PURITY TEST. —*Not manufactured.*

Tobacco contains, in addition to other constituents, a liquid alkaloid, *Nicotia* or *Nicotina*, and a concrete volatile oil, *Nicotianin*. *Nicotia* or *Nicotina* ($C_{10}H_{14}N_2$) is a colourless oily liquid, but when exposed to the atmosphere it turns first yellow, then brown, and finally becomes solid by the absorption of oxygen. It is inflammable, has an irritating odour, and an acrid, burning taste. It is soluble in alcohol, ether, water, and the fixed and volatile oils. It exists in the leaves, roots, seeds, and smoke of tobacco.

ENEMA TABACI—ENEMA OF TOBACCO.—*Take of leaf tobacco,* 20 *grains; boiling water,* 8 *fluid ounces. Infuse in a covered vessel for half-an-hour, and strain.*

Dose.—From two to four ounces of the enema, repeated, if requisite, in an hour, if there be no contra-indicating symptoms. Thirty grains of tobacco have caused death.

Antidotes.—Empty the stomach as promptly as possible by stimulating emetics. Powerful stimulants—ammonia, brandy, strong coffee. Vegetable astringents. Strychnia, cautiously administered, as a physiological antidote. Artificial respiration.

Tobacco acts as an acro-narcotic poison, causing extreme nausea, vomiting, and often purging, utter prostration of muscular power; heart's action greatly reduced, pulse small, weak, fluttering, and almost imperceptible; face pale, extremities cold, great anxiety, muscular tremors, and tendency to syncope; pupils dilated, vision impaired, respiration more or less labouring, and the entire body bathed in a cold clammy sweat; paralysis, with occasional convulsive movements and stupor, lead to death. In smaller doses tobacco acts as a sedative and antispasmodic, and somewhat as a diuretic, and as an emetic and laxative. Tobacco is not often used medicinally in consequence of its violent action. It has been given with various results in strangulated hernia, ileus, dysuria, ischuria, tetanus, hydrophobia, spasmodic asthma, rigidity of the os uteri, spasm of the sphincter ani, and other conditions, as an antispasmodic; as a diuretic in dropsies; as a topical application in a variety of skin diseases; as an anthelmintic, &c.

SCROPHULARIACEÆ—The Figwort Order.—Herbs or undershrubs, universally distributed. Some of the species possess acrid, others sedative properties. Officinal plant: *Digitalis purpurea.*

Digitalis Folia—Digitalis leaves.—Officinal plant: *Digitalis purpurea*, Linn.; *Didynamia Angiospermia;* Purple Foxglove. Illustra-

tion, plate 48, fasc. i., *Flor. Lond.* The dried leaves; from wild indigenous plants, gathered when about two-thirds of the flowers are expanded. Officinal preparations: *Digitalinum, Infusum Digitalis, Tinctura Digitalis.*

Botany.—Herbaceous, biennial. *Stem*, erect, three or four feet high, simple, roundish, slightly angular, and downy. *Leaves*, alternate, downy, dull green, ovate-lanceolate or oblong, and ramified with veins. *Inflorescence*, racemose, terminal, erect, one-sided. *Flowers*, numerous, pendulous, inodorous; corolla campanulate, crimson, internally hairy and marked with eye-like spots. *Seeds*, small, roundish, somewhat angular, greyish-brown. *Habitat*, indigenous, growing in pastures, hedge-rows, and upon banks.

Characters of the Leaves. — *Ovate lanceolate, shortly petiolate, rugose, downy, paler on the under surface, crenate.*

The leaves, of the second year, are to be gathered in the month of July, when two-thirds of the flowers are expanded, and before the ripening of the seeds. After the removal of the stalks and mid-ribs, the leaves are dried in baskets in a dark place by means of a stove heat. The dried leaves and powder are prone to change, losing their medicinal properties by keeping; they should, therefore, be kept from the influence of air and light, and should be renewed annually. The leaves of other plants are sometimes substituted for them, especially those of several species of the genus *Verbascum*, and of *Inula*. When carefully dried and preserved they are of a bright green colour, have but little odour, but a nauseous, bitter, acrid taste. Besides other constituents, they contain

Digitalinum — Digitalin. — The active principle obtained from Digitalis.

Preparation. — *Take of digitalis leaf, in coarse powder,* 40 *ounces; rectified spirit; distilled water; acetic acid; purified animal charcoal; solution of ammonia; tannic acid; oxide of lead, in fine powder; pure ether, of each, a sufficiency. Digest the digitalis with a gallon of the spirit, for twenty-four hours, at a temperature of* 120°, *then put them into a percolator, and when the tincture has ceased to drop, pour a gallon of spirit on the contents of the percolator, and allow it slowly to percolate through. Distil off the greater part of the spirit from the tincture, and evaporate the remainder over a water-bath until the whole of the alcohol has been dissipated. Mix the residual extract with five ounces of distilled water, to which half-an-ounce of acetic acid has been previously added, and digest the solution thus formed with a quarter of an ounce of purified animal charcoal; then filter and dilute the filtrate with distilled water until it measures a pint. Add solution of ammonia nearly to neutralisation, and afterwards add one hundred and sixty grains of tannic acid dissolved in three ounces of distilled water. Wash the precipitate that will be formed with a little distilled water; mix it with a small quantity of the spirit and a quarter of an ounce of the oxide of lead, and rub them together in a mortar. Place the mixture in a flask, and add to it four ounces of the spirit; raise the temperature to* 160°, *and keep it at this heat for about an hour; then add a quarter of an ounce of purified animal charcoal; put it on a filter, and from the filtrate carefully drive off*

the spirit by the heat of a water-bath. Lastly, wash the residue repeatedly with pure ether.

Rationale.—The tincture of digitalis, prepared in the first part of the process, contains the digitalin, together with colouring matter, extractive, &c. The spirit is recovered by distillation, and the extract thus formed is heated with distilled water and acetic acid, the latter of which dissolves the digitalin, whilst the subsequent treatment with charcoal partially decolorises it. By the addition of ammonia, acetate of ammonia is formed, and digitalin is liberated, and the latter, uniting with the tannic acid, next added, is precipitated. On the addition of litharge, tannate of lead is formed, and digitalin again set free. By heating this mixture with spirit, a tincture of digitalin is formed, and to this more animal charcoal is added, to remove colouring matter and extractive. Finally, the tannate of lead and the charcoal are removed by filtration, the spirit is recovered by distillation, and the residual digitalin is further purified by repeated washings with ether.

CHARACTERS.—*In porous mammillated masses or small scales, white, inodorous, and intensely bitter; readily soluble in spirit, but almost insoluble in water and in pure ether; dissolves in acids, but does not form with them neutral compounds; its solution in hydrochloric acid is of a faint yellow colour, but rapidly becomes green. It powerfully irritates the nostrils, and is an active poison.*

PURITY TEST.—*Leaves no residue when burned with free access of air.*

It is a neutral non-nitrogenised principle, and can be crystallised only with considerable difficulty.

INFUSUM DIGITALIS—INFUSION OF DIGITALIS.—*Take of digitalis, dried,* 30 *grains; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain. This infusion has half the strength of infusum digitalis,* Ed. Dub.

TINCTURA DIGITALIS—TINCTURE OF DIGITALIS.—*Take of digitalis leaves, in coarse powder,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the digitalis for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose. — Of digitalis in powder, half-a-grain to two grains; of the infusion, two fluid drachms to two fluid ounces; of the tincture, ten minims to a fluid drachm. In the smaller doses, repeated three times a-day, the preparations act as diuretics, and their action should be facilitated by diluents, in combination with other diuretics; in the larger doses, they act as sedatives, and such doses should be cautiously approached. The tincture has been given in doses of half a fluid ounce, and even more than that; but the indiscriminate use of so powerful a remedy in such doses would be highly dangerous. Digitalin is given in doses of one-fiftieth to one-twentieth of a grain; it is not suited for extempore preparations, and therefore is usually prescribed in the form of *digitalin granules,* each of which contains one-fiftieth of a grain; the dose is one granule, cautiously increased to four or five.

Antidotes.—Empty the stomach by a stimulating emetic, or by means of the stomach-pump; powerful stimulants, such as ammonia, brandy, strong coffee; keep the patient in the recumbent posture, in order to avoid fatal syncope, which might be the result of rising to the erect posture; vegetable astringents, such as tea, or infusion of galls, may be tried. When the symptoms arise not from a single over-dose, but from an accumulation of medicinal doses, stop the medicine, keep the patient in the recumbent posture, administer a moderate quantity of stimulants at short intervals, and give laxatives and diluents occasionally.

In poisonous doses, or when the smaller doses have been long continued, digitalis produces a powerfully sedative effect upon the heart and the cerebro-spinal system, the alimentary canal being also implicated. The usual symptoms at this stage are, a slow irregular feeble pulse, which is easily excited by assuming a sitting or erect posture, vertigo, nausea, vomiting, confused vision, throbbing, and sense of weight and pain in the frontal region, feebleness of the entire body, cold extremities, loss of sleep, and possibly delirium, stupor, or convulsions. In still larger or poisonous doses, there is generally violent vomiting and purging, severe griping pains, vertigo, utter prostration of body; weak, fluttering, or imperceptible pulse; dilated pupils, cold sweats, suppression of urine, coma, convulsions, and death.

Great diversity of opinion exists as to the real action of digitalis, and statements of the most opposite kind have been made respecting it.

The recent able researches of Dr Brunton, on the actions of this medicine, lead him to believe that digitalis contracts the capillaries throughout the body, while it stimulates at the same time the regulatory nerves of the heart (vagi), and its musculo-motor nerves (sympathetic).

If the drug be increased in quantity, there results paralysis of the vagi, of the sympathetic, and of the capillaries.

By this means he is able to explain rationally what has been observed by experimenters on animals; viz., that digitalis

1. Reduces the number of beats of the heart, but does not make them irregular.
2. The pulse still remains slow, with now and then a quick beat.
3. The pulse becomes quick, with now and then a slow beat.
4. The action of the heart becomes peristaltic, and finally fails altogether.

On Dr Brunton's theory the primary slowing of the pulse, which

is at the same time increased in volume and tension, is due to stimulation of the inhibitory nerves of the heart, and to the increased obstruction presented to the passage of blood through the diminished capillary area. The interpolation of an occasional quick beat during the second stage is accounted for on the supposition that the vagus is now beginning to get paralysed, and occasionally fails to rein in the musculo-motor nerves of the heart.

The third stage indicates the almost complete paralysis of the vagus, which allows the sympathetic, though itself getting weak, to almost entirely prevail. The last stage indicates paralysis of the vagus, of the sympathetic supply to the heart, and of the capillaries. In cases of poisoning with digitalis death is found to result from paralysis of the heart, the right side is found engorged, and the venous system usually full. If these views are correct, and they render intelligible, at least, what was formerly chaotic in the extreme, it follows that in small doses digitalis would slow the pulse but strengthen it at the same time, and this coincides with what is the general belief among practical men.

Therapeutically, digitalis acts as a cardiac, sedative, and tonic, a hæmostatic and diuretic.

It is employed as a sedative in heart disease when the circulation is tumultuous and irregular, but ought to be prescribed with great care, lest the sedative action be allowed to proceed too far.

It acts as a tonic upon a dilated, weak heart, but its effects need to be well watched, lest over action of the weak cardiac organ exerted upon an arterial tension, greatly increased by the contracted condition of the capillaries, lead to rupture of some of its fibres. It is also generally believed that in hypertrophied heart with aortic insufficiency, digitalis is peculiarly apt to precipitate the sudden death by syncope, which is constantly liable to occur in those cases. It is also of the first importance that a patient deeply under the influence of digitalis should be prevented from making any sudden exertion. It is used also as a sedative in delirium tremens, in acute inflammations, such as pleurisy and pneumonia; in asthma, in bronchitis, in croup, in epilepsy, in acute mania, and in many other disorders. As a hæmostatic, digitalis is found useful in hæmoptysis, epistaxis, post partum hæmorrhage, &c.

As a diuretic, it is especially useful in dropsy due to cardiac disease, and may be well combined with squill, or with squill and blue pill. It is also useful, though not so efficacious, in cases of dropsy into serous cavities, as into the peritoneum. In the latter

condition a strong infusion, applied externally, is found greatly to aid the internal administration.

LABIATÆ or LAMIACEÆ—The Labiate or Dead-Nettle Order.—Herbs or undershrubs, inhabiting temperate climates. The medicinal properties of the plants are due to the presence of a volatile oil, to which also they owe their fragrance; many of them contain stearoptene, and some of them a little bitter and astringent principle. Some of them act as tonics, but they are chiefly employed as carminatives and antispasmodics. Officinal plants: *Lavandula vera, Mentha piperita, Mentha viridis, Rosmarinus officinalis.*

Oleum Lavandulæ—Oil of Lavender.—Officinal plant: *Lavandula vera,* DC.; *Didynamia Gymnospermia;* Lavender. Illustration, plate 55, *Woodv. Med. Bot.,* (*L. Spica.*) Officinal part: The oil, distilled in Britain from the flowers. Officinal preparations: *Spiritus Lavandulæ, Tinctura Lavandulæ Composita.* It also enters into the composition of *Linimentum Camphoræ Compositum.*

Botany.—An undershrub, one to three feet in height, with oblong-linear or lanceolate, entire leaves. *Inflorescence,* interrupted spikes; flowers, purplish-grey, in whorls of six to ten flowers. *Habitat,* south of Europe; largely cultivated.

Characters of the Oil.—*Colourless or pale yellow, with the odour of lavender, and a hot bitter aromatic taste.*

SPIRITUS LAVANDULÆ—Spirit of Lavender.—*Take of oil of lavender,* 1 *fluid ounce; rectified spirit,* 49 *fluid ounces. Dissolve.*

This is one-fifth the strength of the preparation of the same name in the British Pharmacopœia of 1864.

TINCTURA LAVANDULÆ COMPOSITA—Compound Tincture of Lavender.—*Take of oil of lavender,* 1½ *fluid drachm; oil of rosemary,* 10 *minims; cinnamon bark, bruised; nutmeg, bruised, of each,* 150 *grains; red sandal-wood,* 300 *grains; rectified spirit,* 2 *pints. Macerate the cinnamon, nutmeg, and red sandal-wood in the spirit for seven days in a closed vessel, with occasional agitation, then press, strain, and dissolve the oils in the strained tincture, and add sufficient rectified spirit to make two pints.*

Dose.—Of the oil, two to five minims; of the spirit, one-half to one fluid drachm; of the compound tincture, thirty minims to two fluid drachms.

Lavender acts as an aromatic stimulant and stomachic; its preparations are usually employed as adjuncts to other medicines, but may be given separately either in water or dropped upon sugar.

Oleum Menthæ Piperitæ—Oil of Peppermint.—Officinal plant; *Mentha piperita,* Linn.; *Didynamia Gymnospermia;* Peppermint. Illustration, plate 169, *Woodv. Med. Bot.* Officinal part: The oil, distilled in Britain from the fresh herb when in flower. Officinal preparations: *Aqua Menthæ Piperitæ, Essentia Menthæ Piperitæ, Spiritus Menthæ Piperitæ.* Enters into *Pilula Rhei Composita.*

Botany. — Perennial herb. *Root,* creeping. *Stem,* erect, smooth, quadrangular. *Leaves,* ovate-oblong, acute, serrated, smooth. *Inflorescence,* lax spikes; flowers violet coloured. *Habitat,* indigenous; extensively cultivated.

CHARACTERS OF THE OIL.—*Colourless or pale yellow, with the odour of peppermint; taste warm aromatic, succeeded by a sensation of coldness in the mouth.*

AQUA MENTHÆ PIPERITÆ—PEPPERMINT WATER.—*Take of oil of peppermint, $1\frac{1}{2}$ fluid drachm; water, $1\frac{1}{2}$ gallon. Distil one gallon.*

Is a constituent of Mistura Ferri Aromatica.

ESSENTIA MENTHÆ PIPERITÆ—ESSENCE OF PEPPERMINT.—*Take of oil of peppermint,* 1 *fluid ounce; rectified spirit,* 4 *fluid ounces. Mix.*

This is double the strength of the preparation of the same name in the Dublin Pharmacopœia.

SPIRITUS MENTHÆ PIPERITÆ—SPIRIT OF PEPPERMINT.—*Take of oil of peppermint,* 1 *fluid ounce; rectified spirit,* 49 *fluid ounces. Dissolve.*

This is one-fifth the strength of the preparation of the same name in the British Pharmacopœia of 1864.

Dose.—Of the oil, two to five minims, dropped upon sugar; of the essence, ten to twenty minims; of the spirit, one-half to one fluid drachm, on sugar or in water; of the water, one to two or three fluid ounces.

Peppermint acts as an aromatic stimulant, carminative, stomachic, and antispasmodic, and as such its preparations are given either alone or with other medicines, to disguise their taste and odour, or to correct their irritating and griping qualities. They are also much used to overcome flatulence.

Oleum Menthæ Viridis—Oil of Spearmint.—Officinal plant: *Mentha viridis,* Linn.; *Didynamia Gymnospermia;* Spearmint. Illustration, plate 170, *Woodv. Med. Bot.* Officinal part: The oil distilled in Britain from the fresh herb when in flower. Officinal preparation: *Aqua Menthæ Viridis.*

Botany.—Perennial herb. *Root,* creeping. *Stem,* erect, smooth. *Leaves,* ovate-lanceolate, sessile, smooth. *Inflorescence,* loose spikes. *Habitat,* indigenous.

CHARACTERS OF THE OIL.—*Colourless or pale yellow, with the odour and taste of spearmint.*

AQUA MENTHÆ VIRIDIS—SPEARMINT WATER.—*Take of oil of spearmint, $1\frac{1}{2}$ fluid drachm; water, $1\frac{1}{2}$ gallon. Distil one gallon.*

Dose.—Of the oil, one to five minims; of the water, one to two fluid ounces.

Spearmint acts as an aromatic stimulant, carminative, and stomachic, and, as such, the water is employed as a vehicle for other medicines.

Oleum Rosmarini — Oil of Rosemary. — Officinal plant: *Rosmarinus officinalis*, Linn.; *Diandria Monogynia*; Rosemary. Illustration, plate 24, *Steph. and Church. Med. Bot.* Officinal part: The oil distilled from the flowering tops. Officinal preparation: *Spiritus Rosmarini;* enters into *Linimentum Saponis* and *Tinctura Lavandulæ Composita.*

Botany.—A leafy shrub, five to seven feet high. *Leaves,* opposite, sessile, linear, hoary beneath. *Inflorescence,* short axillary racemes; flowers, greyish-blue or lavender-coloured. *Habitat,* south of Europe, cultivated in England.

CHARACTERS OF THE OIL.—*Colourless, with the odour of rosemary, and a warm aromatic taste.*

SPIRITUS ROSMARINI—SPIRIT OF ROSEMARY.—*Take of oil of rosemary,* 1 *fluid ounce; rectified spirit,* 49 *fluid ounces. Dissolve.*

This is one-fifth the strength of the preparation of the same name in the British Pharmacopœia of 1864.

Dose.—Of the oil, one to five minims, on sugar; of the spirit, one-half to one fluid drachm.

Rosemary acts as an aromatic stimulant, carminative, and stomachic. The oil is sometimes added to liniments for the sake of its fragrance. The spirit is often added to hair washes.

Mentha pulegium, Pennyroyal; and *Origanum vulgare,* Common Marjarum; both yield volatile oils, which act as aromatic stimulants and carminatives. *Mellissa officinalis*—Common Balm—is used in the form of infusion or balm tea, as a mild stimulant. *Marrubium vulgare*—Common White Horehound—is also used as a mild stimulant and aromatic tonic expectorant in chronic coughs.

SUB-CLASS IV.—MONOCHLAMYDEÆ OR APETALÆ.

1. *Angiospermæ.*

POLOGONACEÆ—The Buckwheat Order—Herbs, rarely shrubs, generally distributed both in cold and warm climates. The plants possess acid, astringent, and purgative properties. Officinal plants: One or more undetermined species of Rheum.

Rhei Radix—Rhubarb Root—Officinal plants: One or more undetermined species of Rheum. Officinal part: The root, deprived of the bark and dried; from Chinese Thibet and Tartary. Officinal preparations: *Extractum Rhei, Infusum Rhei, Pilula Rhei Composita, Pulvis Rhei Compositus, Syrupus Rhei, Tinctura Rhei, Vinum Rhei.*

CHARACTERS OF RHUBARB.—*Trapezoidal roundish, cylindrical or flattish pieces, frequently bored with one hole, yellow externally, internally*

marbled with fine waving greyish and reddish lines, finely gritty under the teeth; taste bitter, faintly astringent and aromatic; odour peculiar.

Purity Tests.—*Free from decay, not worm eaten. Boracic acid does not turn the yellow exterior brown.*

Most of the rhubarb of commerce is produced near Thibet. The species from which rhubarb is derived is still undetermined; *Rheum palmatum, R. rhaponticum, R. emodi, R. australe, R. compactum, R. undulatum,* and others, have been referred to. All the species have perennial roots, with large annual root leaves, and a herbaceous flowering stem from two to four feet high, and paniculate inflorescence. The roots are gathered in summer from plants about six years of age. After it is dug up, the root is cleansed and peeled, then cut into pieces, and suspended, by passing a string through a hole bored in each piece, to dry, generally by exposure to the sun. Several varieties of rhubarb are recognised in commerce: *Russian* or *Muscovite* rhubarb, called also *Turkey, Bucharian,* or *Siberian* rhubarb, occurs in pieces about two or three inches in length, roundish, cylindrical, or flattened on one side and convex on the other, and bearing on its surface the angular markings caused by cutting away the root bark; it may or may not be perforated. Bucharian rhubarb is an inferior quality. Siberian rhubarb is seldom met with; it occurs in long, thin, cylindrical, or spindle-shaped pieces. *Chinese* or *East Indian rhubarb* consists of *Batavian* or *Dutch-trimmed rhubarb,* each piece of which is perforated, and not unfrequently has the string upon which it was suspended to dry left in the hole; it resembles the Russian kind: *half-trimmed rhubarb,* which is not angular but smooth on the surface, in consequence of its bark having been rasped and not cut off; it is inferior to the Russian and Dutch-trimmed kinds: and *Canton stick rhubarb,* which occurs in cylindrical pieces, about two or three inches in length, and three-quarters of an inch thick. *English rhubarb* is spongy in texture, and softer than the Eastern varieties; it occurs in two forms, one called *dressed* or *trimmed* rhubarb, the other *stick* rhubarb; the former is the better kind, and is made up to resemble the Eastern kinds, to which it is much inferior. There are other kinds of rhubarb, such as *Himalayan* or *Emodi* rhubarb, *French* rhubarb, &c. The chief constituents of rhubarb are a volatile oil in minute quantity; a neutral principle termed *Rheine* (called also *Chrysophanic acid*); three acid resins termed *Aporetine, Phœoretine,* and *Erythroretine;* tannic and gallic acids; bitter extractive, crystallised oxalate of lime, starch, sugar, &c. Rhubarb is frequently adulterated, and good and bad varieties are often mixed. The inferior kinds may be known by the brown specks and cavities, and the boracic acid test will detect the presence of turmeric powder, which is often rubbed over inferior kinds of rhubarb to give them a better appearance.

EXTRACTUM RHEI.—Extract of Rhubarb.—*Take of rhubarb root, sliced or bruised,* 1 *pound; rectified spirit,* 10 *fluid ounces; distilled water,* 5 *pints. Mix the spirit and the water, and macerate the rhubarb in the mixture for four days; then decant, press, and set by, that the undissolved matter may subside; pour off the clear liquor, filter the remainder, mix the liquors, and evaporate by a water-bath at a temperature not exceeding* 160°, *until the extract has acquired a suitable consistence for forming pills.*

INFUSUM RHEI—INFUSION OF RHUBARB.—*Take of rhubarb root, in thin slices,* ¼ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain.*

PILULA RHEI COMPOSITA—COMPOUND RHUBARB PILL.—*Take of rhubarb root, in powder,* 3 *ounces; socotrine aloes, in powder,* 2¼ *ounces; myrrh, in powder; hard soap, in powder, of each,* 1½ *ounce; oil of peppermint,* 1½ *fluid drachm; treacle, by weight,* 4 *ounces. Mix the powders with the oil, then add the treacle, and beat the whole into a uniform mass.*

PULVIS RHEI COMPOSITUS—COMPOUND POWDER OF RHUBARB.—*Take of rhubarb root, in powder,* 2 *ounces; light magnesia,* 6 *ounces; ginger, in powder,* 1 *ounce. Mix them thoroughly, and pass the powder through a fine sieve.*

SYRUPUS RHEI—SYRUP OF RHUBARB.—*Take of rhubarb root, in coarse powder; coriander fruit, in coarse powder, of each,* 2 *ounces; refined sugar,* 24 *ounces; rectified spirit,* 8 *fluid ounces; distilled water,* 24 *fluid ounces. Mix the rhubarb and coriander; pack them in a percolator; pass the spirit and water, previously mixed, slowly through them; evaporate the liquid that has thus passed until it is reduced to thirteen fluid ounces, and in this, after it has been filtered, dissolve the sugar with a gentle heat.*

TINCTURA RHEI—TINCTURE OF RHUBARB.—*Take of rhubarb root, in coarse powder,* 2 *ounces; cardamom seeds, freed from the pericarps, and bruised; coriander fruit, bruised; saffron, of each,* ¼ *ounce; proof spirit,* 1 *pint. Macerate the solid ingredients for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

VINUM RHEI—WINE OF RHUBARB.—*Take of rhubarb root, in coarse powder,* 1½ *ounce; cannella alba bark, in coarse powder,* 60 *grains; sherry,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation; then strain, press, filter, and add sufficient sherry to make one pint.*

Dose.—Of powdered rhubarb, five to ten grains as a stomachic and tonic, twenty to forty grains as a purgative. Of the extract, five to twenty grains as a purgative. Of the infusion, half a fluid ounce to two fluid ounces. Of the compound pill, five to twenty grains. Of the compound powder (commonly called *Gregory's Powder*), five to ten grains for children, twenty to sixty grains for adults, as an antacid and mild stomachic purgative. Of the syrup, one to four fluid drachms. Of the tincture, thirty minims to two fluid drachms as a stomachic, four to eight fluid drachms as a purgative. Of the wine, one to two fluid drachms as a stomachic.

Rhubarb acts as an astringent, tonic, stomachic, and purgative. In small doses it acts as a tonic, improving the digestion; for this purpose it enters into the composition of most *dinner pills.* In

larger doses it is purgative, acting chiefly by increasing the peristaltic action of the bowels throughout their entire extent, but especially in the duodenum, rather than by increasing the secretions of the alimentary canal. Rhubarb acts secondarily as an astringent, causing constipation after its purgative effects have passed off. The colouring matter of rhubarb is taken into the circulation and passes out by the urine, which, if it be alkaline at the time, is apt to assume a deep-red colour, which might be mistaken for hæmaturia. Rhubarb is an excellent purgative for children when there is much irritation of the alimentary canal, for it first eliminates irritating matters, and then by its astringency prevents subsequent diarrhœa. For adults this tendency to cause constipation renders it objectionable as an ordinary laxative, but it is useful in diarrhœa, dysentery, &c., and may be combined with other drugs, as in the compound pill and powder, so as to answer a variety of purposes.

Polygonum Bistorta.—Bistort Root was formerly officinal, and was employed for the sake of its astringent properties. Several species of the genus Rumex have been used medicinally ; *Rumex Acetosa,* or common sorrel, was employed as a refrigerant, diuretic, and antiscorbutic.

LAURACEÆ—The Laurel Order.—Trees, inhabiting tropical regions. The plants are aromatic and fragrant, yielding fixed and volatile oils, and camphor. Officinal plants : *Sassafras officinale, Camphora officinarum, Cinnamomum zeylanicum, Nectandra Rodiœi.*

Sassafras Radix—Sassafras Root.—Officinal plant : *Sassafras officinale,* Nees. ; *Enneandria Monogynia ;* the Sassafras tree. Illustration, plate 31, *Woodv. Med. Bot.* (*Laurus sassafras*). Officinal part : The dried root ; from North America. Enters into *Decoctum Sarsæ Compositum.*

Botany.—In favourable situations, tall and straight, but usually a small diœcious tree. *Leaves,* alternate, petiolate, thin, downy, wedge-shaped at the base, and generally three-lobed. *Inflorescence,* racemose ; flowers, yellowish-green, appearing before the leaves, somewhat fragrant. *Fruit,* a succulent, oval, deep-blue berry. *Habitat,* North America.

Characters.—*In branched pieces, sometimes eight inches in diameter at the crown ; bark externally greyish-brown, internally rusty-brown, of an agreeable odour, and a peculiar aromatic warm taste ; wood light, porous, greyish-yellow, more feeble in odour and taste than the bark. Also in chips.*

The chief constituents of the root are a peculiar principle termed *Sassafrid,* heavy and volatile oils, tannin, resin, extractive, gum, albumen, &c. Volatile oil of sassafras is of a light yellow colour, has a pungent taste, and the odour of sassafras.

Sassafras acts as a stimulating diaphoretic, but is not uniform in its effects ; the oil acts as an aromatic stimulant, and may be given

in doses of two to eight or ten minims. Sassafras chips may be made into an infusion, but it is seldom given alone. It enters into the compound decoction of sarsaparilla.

Camphora — Camphor.—Officinal plant: *Camphora officinarum*, Nees; *Enneandria Monogynia;* the Camphor Laurel. Illustration, plate 155, *Woodv. Med. Bot.* (*Laurus camphora*). Officinal part: A concrete volatile oil, obtained from the wood by sublimation, and resublimed in bell-shaped masses; imported from China. Officinal preparations: *Aqua Camphoræ, Linimentum Camphoræ, Linimentum Camphoræ Compositum, Spiritus Camphoræ, Tinctura Camphoræ Composita*, enters into *Linimentum Aconiti, L. Belladonnæ, L. Chloroformi, L. Hydrargyri, L. Iodi, L. Opii, L. Saponis, L. Terebinthinæ, L. Terebinthinæ Aceticum, Unguentum Plumbi Subacetatis Compositum, Unguentum Hydrargyri Compositum.*

Botany.—A handsome evergreen tree, straight below, and branching at the top, emitting a camphoraceous odour when bruised in any part. *Leaves*, alternate, oval, acuminate, bright green and shining above, pale beneath, smooth, triple-nerved. *Inflorescence*, axillary terminal corymbose panicles; flowers, small, hermaphrodite, yellowish-white. *Fruit*, a small, round, blackish-red berry, about the size of a black currant. *Habitat*, China, Japan, Cochin-China, Formosa.

CHARACTERS OF CAMPHOR.—*White, translucent, tough, and crystalline; has a powerful penetrating odour, and a pungent taste followed by a sensation of cold; floats on water; volatilises slowly at ordinary temperatures; is slightly soluble in water, but readily soluble in rectified spirit and in ether.*

PURITY TEST.—*Sublimes entirely when heated.*

Camphor is obtained from the root, trunk, and branches of the tree, by boiling the chips in water, and collecting the camphor, as it sublimes, into an earthen capital. In this state it constitutes *crude* camphor. It is afterwards purified by resublimation into glass vessels, quicklime being previously mixed with it to withhold the impurities. It occurs in hemispherical cakes, about three inches in thickness. It is tough and difficult to powder, unless a little rectified spirit be added. It floats on water, its specific gravity being ·98 to ·99. It volatilises slowly at the ordinary temperature of the atmosphere, and crystallises on the walls of the vessels in which it is kept. It is regarded as a solid volatile oil, having the constitution $C_{10}H_{16}O$. *Artificial Camphor* (Hydrochlorate of Turpentine) ($C_{10}H_{16}HCl$) may be made by acting upon oil of turpentine with hydrochloric acid. It resembles true camphor in many of its properties, but may be recognised by burning with a sooty flame, and emitting the odour of turpentine when heated. (For Borneo Camphor, see page 370.)

AQUA CAMPHORÆ—CAMPHOR WATER.—Synonym: *Mistura Camphoræ*, Lond., Edin., Dub.—*Take of camphor, broken into pieces, ½ ounce; distilled water, 1 gallon. Enclose the camphor in a muslin bag, and attach this to one end of a glass rod, by means of which it may be kept at the bottom of a bottle containing the distilled water, the other end of the rod terminating just below the stopper of the bottle. Having thus put the*

camphor into the water, close the mouth of the bottle, macerate for at least two days, and then pour off the solution when it is required.

LINIMENTUM CAMPHORÆ—Liniment of Camphor—*Take of camphor,* 1 *ounce; olive oil,* 4 *fluid ounces. Dissolve the camphor in the oil.*

LINIMENTUM CAMPHORÆ COMPOSITUM—Compound Liniment of Camphor.—*Take of camphor,* 2½ *ounces; oil of lavender,* 1 *fluid drachm; strong solution of ammonia,* 5 *fluid ounces; rectified spirit,* 15 *fluid ounces. Dissolve the camphor and oil of lavender in the spirit; then add the solution of ammonia gradually, shaking them together until a clear solution is formed.*

SPIRITUS CAMPHORÆ—Spirit of Camphor.—*Take of camphor,* 1 *ounce; rectified spirit,* 9 *fluid ounces. Dissolve.*

TINCTURA CAMPHORÆ COMPOSITA—Compound Tincture of Camphor.—Synonyms: Tinctura Camphoræ cum Opio, 1864; Tinctura Opii Camphorata, *Edin., Dub.—Take of opium, in coarse powder; benzoic acid, of each,* 40 *grains; camphor,* 30 *grains; oil of anise,* ½ *fluid drachm; proof spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient proof spirit to make one pint.*

Dose.—Of camphor, one to five or ten grains, in pill or emulsion, suspended by means of mucilage, sugar, or yolk of egg; the latter is the better mode, as when given in the solid form it is apt to cause uneasiness. Of camphor water, one to two fluid ounces; the quantity of camphor dissolved in the water is so small that it can produce little more than the flavour and odour of the drug; it is useful as a vehicle for more potent remedies. Spirit of camphor is chiefly used externally, as an application to rheumatic pains, sprains, bruises, chilblains, &c.; the addition of water causes a separation of part of the camphor, but by combining it with mucilage an emulsion can be made which may be given internally. Camphorated tincture of opium (English Paregoric) may be given in doses of thirty minims to two or three fluid drachms; one fluid ounce contains two grains of opium. Liniment of camphor is a stimulating embrocation, and is useful as an application to sprains, bruises, rheumatic and other local pains. Compound liniment of camphor acts as a powerful rubefacient and counter-irritant; it contains no oleaginous ingredient.

Camphor, in small doses (gr. ii.—v.—x.), acts as a stimulant, increases the action of the heart and arteries, exhilarates the spirits, and produces increase of the temperature of the body and excites diaphoresis. The pulse is made softer and fuller. But these effects are speedily followed by symptoms of depression. In doses somewhat larger, it is antispasmodic, anodyne, and hypnotic. In large doses it is a narcotico-irritant poison, producing vomiting, delirium, vertigo, and convulsions, acting chiefly on the nervous system. Camphor also acts powerfully upon the genito-urinary system.

Therapeutically, camphor is employed as a stimulant, sedative, anodyne, antispasmodic, diaphoretic, anaphrodisiac. As a *stimulant,* in typhus and typhoid fevers, and in low febrile conditions generally; in asthenic inflammations; to promote the reappearance of exanthemata; in summer diarrhœa and cholera; and locally as a lotion or liniment to bed-sores, sprained joints, &c., &c. As a *sedative,* in the delirium of fever, accompanied by depression of nervous energy and of the vital powers. In such cases it needs to be given in large doses (gr. xx. every two hours). In delirium tremens, associated with great exhaustion, when, from the general condition, morphia seems inadmissible. It should be given in doses of two to three grains every third hour. In irritable conditions of the nasal mucous membrane, with much sneezing, and frontal headache (Ringer); in insanity, in puerperal mania, in uterine irritability, in chordee, in cases of poisoning from irritant substances, which act specifically upon the genito-urinary organs, such as cantharides, squill, &c. As an *antispasmodic,* it is administered in asthma, emphysema, and in chronic coughs generally, in epilepsy, in hysteria. As an *anodyne,* it is applied externally in neuralgic headache, in painful burning skin eruptions, in chronic eczema and prurigo; as a liniment to the pains in the loins of pregnant women; to relieve the after pains of labour; also in pruritus muliebrium, in toothache, &c. As a *diaphoretic* it is not very active, but is a useful adjunct to other diaphoretics. As an *anaphrodisiac,* in nymphomania and spermatorrhœa. It exerts an undoubtedly sedative effect upon the genital organs when administered in large doses. Its anaphrodisiac effects were known to the ancient physicians.

Cinnamomi Cortex—Cinnamon Bark.—Officinal plant: *Cinnamomum zeylanicum,* Nees; *Enneandria Monogynia;* Ceylon Cinnamon. Illustration, plate 123, *Wight, Icon. Plant. Ind. Orient.* Officinal parts:—1. The inner bark of shoots from the truncated stock; imported from Ceylon, and distinguished in commerce as Ceylon cinnamon. 2. *Oleum Cinnamomi*—Oil of cinnamon.—The oil, distilled from cinnamon; imported from Ceylon. Officinal preparations: *Aqua Cinnamomi, Pulvis Cinnamomi Compositus, Tinctura Cinnamomi;* enters into *Tinctura Lavandulæ Composita, Acidum Sulphuricum Aromaticum, Decoctum Hæmatoxyli, Infusum Catechu, Pulvis Catechu Compositus, Pulvis Cretæ Aromaticus, Pulvis Kino Compositus, Tinctura Cardamomi Composita, Tinctura Catechu,* and *Vinum Opii.*

Botany.—A tree about thirty feet high. The shoots are somewhat four-cornered, smooth, and shining. *Leaves,* opposite, ovate, or ovate-oblong, terminating in an obtuse point, triple-nerved. *Inflorescence,*

terminal, axillary panicles. *Flowers,* somewhat silky. *Habitat,* Ceylon; cultivated elsewhere.

Characters of Cinnamon.—*About one-fifth of a line thick, in closely-rolled quills, which are about four lines in diameter, containing several small quills within them, light yellowish-brown, with a fragrant odour and warm sweet aromatic taste; breaks with a splintery fracture.*

Characters of the Oil.—*Yellowish when recent, gradually becoming red, having the odour and taste of cinnamon. Sinks in water.*

The cinnamon of commerce is the inner bark of the shoots of trees three years of age. The branches are struck off in the rainy season, the bark is immediately peeled off, and the epidermis and green pulpy matter are at once removed; the smaller pieces of the inner bark are then placed within the larger, and the whole is dried in the sun, when it rolls up into the form in which we see it. The volatile oil is obtained by macerating the coarser pieces of the bark in sea-water, and distilling them. From the ripe fruit is obtained a fatty substance called *Cinnamon Suet.* Cinnamon contains, besides its volatile oil, tannin, resin, colouring matter, &c. The essential part of the volatile oil (Hydruret of Cinnamyle), by exposure to the air, combines with oxygen, and is converted into cinnamic acid and two peculiar resins and water. The bark and volatile oil of cassia (*Chinese Cinnamon,* so-called) are frequently substituted for those of cinnamon. The false bark is thicker, and the false oil is less fragrant and more acrid and burning.

AQUA CINNAMOMI — Cinnamon Water. — *Take of cinnamon, bruised,* 20 *ounces; water,* 2 *gallons. Distil one gallon.*

PULVIS CINNAMOMI COMPOSITUS—Compound Powder of Cinnamon. *Synonym:* Pulvis Aromaticus, Edin.—*Take of cinnamon bark, in powder; cardamom seeds, in powder; ginger, in powder, of each,* 1 *ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.*

TINCTURA CINNAMOMI—Tincture of Cinnamon.—*Take of cinnamon bark, in coarse powder,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the cinnamon for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of cinnamon in powder, ten to twenty grains; of oil of cinnamon, one to five minims; of cinnamon water, one to two fluid ounces; of aromatic powder (a stimulant, aromatic, and carminative powder), five to twenty or thirty grains; of the tincture, thirty minims to two cr three fluid drachms.

Cinnamon acts as a mild stimulant, carminative, and antispasmodic. Its preparations are used as adjuncts to, or vehicles for more potent remedies, to produce a slightly stimulant action, to

impart flavour, or correct irritating and griping qualities. The bark, volatile oil, and other preparations of cassia, which were formerly officinal, may be used in the same doses, and for the same purposes, as true cinnamon and its preparations.

Nectandræ Cortex—Bebeeru Bark.—Officinal Plant: *Nectranda Rodiæi*, Schomburgk, in *Hooker's Jour. of Bot.*, 2nd ser.; *Dodecandria Monogynia;* the Bebeeru or Greenheart Tree. Officinal part: The bark; imported from British Guiana. Officinal preparation: *Beberiæ Sulphas.*

Botany.—A tall forest tree. *Leaves,* opposite, oblong, acute, entire, shining. *Inflorescence,* cymose, axillary. *Flowers,* have the odour of jessamine. *Habitat,* British Guiana.

CHARACTERS OF THE BARK.—*In large flat heavy pieces, from one to two feet long, from two to six inches broad, and about a quarter of an inch thick. External colour greyish-brown, internal dark cinnamon-brown. Taste strongly and persistently bitter, with considerable astringency.*

Bebeeru Bark contains a peculiar bitter alkaloid, *Beberia,* and besides that, tannic acid and other constituents. Beberia is uncrystallisable, and occurs either as a yellow amorphous resinoid substance, or as a white powder. It is but little soluble in water, more so in ether, and readily so in alcohol. It was discovered by Mr Rodie, R.N. (hence the name of the species, Rodiæi), and was subsequently investigated by Dr Douglas Maclagan, of this city. Its constitution is believed to be isomeric with morphia. Drs Maclagan and Gamgee have recently discovered another alkaloid in Bebeeru bark, which they name Nectandria, and to which they assign the formula $C_{20}H_{17}NO_4$. They are further of opinion that two other alkaloids exist in the bark.

BEBERIÆ SULPHAS—SULPHATE OF BEBERIA—($C_{35}H_{20}NO_6HO, SO_3$, or $C_{35}H_{40}N_2O_6H_2SO_4$).—*The sulphate of an alkaloid prepared from nectandra or bebeeru bark.*

PREPARATION.—*Take of bebeeru bark, in coarse powder,* 1 *pound; sulphuric acid,* ½ *fluid ounce; slaked lime,* ¾ *ounce, or a sufficiency; solution of ammonia, a sufficiency; rectified spirit,* 16 *fluid ounces, or a sufficiency; diluted sulphuric acid, a sufficiency; water,* 1 *gallon; distilled water, a sufficiency. Add the sulphuric acid to the water, pour upon the bebeeru bark enough of this mixture to moisten it thoroughly; let it macerate for twenty-four hours, place it in a percolator, and pass through it the remainder of the acidulated water. Concentrate the acid liquor to the bulk of one pint, cool, and add gradually the lime in the form of milk of lime, agitating well, and taking care that the fluid still retains a distinct acid reaction. Let it rest for two hours, filter through calico, wash the precipitate with a little cold distilled water, and to the filtrate add solution of ammonia until the fluid has a faint ammoniacal odour. Collect the precipitate on a cloth, wash it twice with ten ounces of cold water, squeeze it gently with the hand, and dry it by the heat of a water-bath. Pulverise the dry precipitate, put it into a flask with six ounces of the rectified spirit, boil, let it rest for a few minutes, and pour off the spirit. Treat the undissolved portion in a similar manner with fresh*

spirit until it is exhausted. Unite the spirituous solutions, add to them four ounces of distilled water, and distil so as to recover the greater part of the spirit. To the residue of the distillation add by degrees, and with constant stirring, diluted sulphuric acid, till the fluid has a slight acid reaction. Evaporate the whole to complete dryness on the water-bath, pulverise the dry product, pour on it gradually one pint of cold distilled water, stirring diligently, filter through paper, evaporate the filtrate to the consistence of a syrup, spread it in thin layers on flat porcelain or glass plates, and dry it at a heat not exceeding 140°. *Preserve the product in stoppered bottles.*

Rationale.—The sulphuric acid abstracts the Beberia from the bark, converting it into the sulphate, which is impure and mixed with colouring matter, &c. The milk of lime is then added (taking care not to neutralise the acid entirely, whereby the alkaloid would be precipitated) for the purpose of removing the excess of acid with a part of the colouring matter and other impurities. Solution of ammonia precipitates the alkaloid, which is still in an impure state, but is further purified by washing with water and boiling with rectified spirit. The spirit is recovered by distillation, and the residual alkaloid is again converted into sulphate by the diluted sulphuric acid; and, finally, this sulphate is still further purified by washing with water and filtering, and is then reduced to thin transparent scales.

CHARACTERS.—*In dark-brown, thin, translucent scales, yellow when in powder, with a strong bitter taste, soluble in water and in alcohol. Its watery solution gives a white precipitate with chloride of barium; and with caustic soda a yellowish-white precipitate, which is dissolved by agitating the mixture with twice its volume of ether. The ethereal solution, separated by a pipette and evaporated, leaves a yellow translucent residue, entirely soluble in dilute acids.*

PURITY TESTS.—*It is entirely destructible by heat. Water forms with it a clear brown solution.*

Dose.—Of sulphate of beberia, one to five grains as a tonic; from ten to twenty or more grains as a febrifuge. Like sulphate of quinine, it requires a little additional sulphuric acid to dissolve it in water.

Sulphate of beberia was introduced by Dr Maclagan as a substitute for quinine, the properties of which it is said to possess, with the advantage of being less liable to produce the excitement and other symptoms of cinchonism or quinism. It is used as a tonic, antiperiodic, and febrifuge in the same cases as quinine. Extended trials of this medicine, however, have been rather disappointing. Dr Maclagan obtained beberia from the celebrated febrifugal nostrum known as Warburg's Fever Drops.

MYRISTICACEÆ—The Nutmeg Order.—Tropical trees possessing acrid and aromatic properties. Officinal plant: *Myristica officinalis.*

Myristica—Nutmeg.—Officinal plant: *Myristica officinalis,* Linn.; *Diœcia Monadelphia;* the Nutmeg tree. Illustration, plate 104,

Steph. and Church. Med. Bot. Officinal parts:—1. The kernel of the seed; imported from Sumatra and the Molucca Islands. 2. *Oleum Myristicæ expressum, or Adeps Myristicæ*—Expressed Oil of Nutmeg.—A concrete oil obtained by means of expression and heat from nutmegs. 3. *Oleum Myristicæ*—Volatile Oil of Nutmeg.—The oil distilled in Britain from nutmeg. Officinal preparations: *Spiritus Myristicæ;* enters into *Pilula Aloes Socotrinæ, Pulvis Cretæ Aromaticus, Pulvis Cretæ Aromaticus cum Opio, Spiritus Ammoniæ Aromaticus, Pulvis Catechu Compositus, Spiritus Armoraciæ Compositus, Tinctura Lavandulæ Composita, Emplastrum Calefaciens, Emplastrum Picis.*

Botany.—A tree from twenty to thirty feet high, resembling a pear tree. *Leaves,* alternate, oblong, smooth, with short stalks, somewhat aromatic. *Inflorescence,* racemose. *Flowers,* few, small, and yellowish. *Fruit,* pyriform or globose, smooth, about the size of a peach; *pericarp,* fleshy, dehiscing from the apex into two nearly equal longitudinal valves, exposing the large, branching, fleshy *arillus* (Mace). which embraces the nut by numerous irregular denticulate stripes. *Nut,* ovoid, consisting of a hard shell, of a glossy dark-brown colour, and an inner thin light-brown coat, which invests the seeds. *Seeds,* or *Nutmegs,* consist chiefly of oleaginous albumen, into which the inner coat dips freely, producing the variegated, brownish-veined appearance. *Habitat,* Molucca Islands; cultivated elsewhere.

CHARACTERS OF THE NUTMEG.—*Oval or nearly round, about an inch in length, marked externally with reticulated furrows, internally greyish-red with dark-brownish veins. It has a strong peculiar odour, and a bitter aromatic taste.*

CHARACTERS OF THE EXPRESSED OIL.—*Of an orange colour, firm consistence, and fragrant odour, like that of nutmeg.*

CHARACTERS OF THE VOLATILE OIL.—*Colourless or straw-yellow, having the odour and taste of nutmegs.*

Nutmegs contain a volatile oil which is obtained by distillation, and a fixed butyraceous oil, which is obtained by expression and heat. *Adeps Myristicæ,* or Butter of Nutmegs, commonly but erroneously called *expressed oil of Mace,* is imported in large, orange-coloured, brick-shaped masses, covered with the leaves of a monocotyledonous plant. It contains a small quantity of volatile oil and two kinds of fat, and by saponification yields myristic acid and glycerine. *Mace* resembles nutmegs in its properties, yielding a volatile oil by distillation, and a fixed oil by pressure.

SPIRITUS MYRISTICÆ—SPIRIT OF NUTMEG.—*Take of volatile oil of nutmeg,* 1 *fluid ounce; rectified spirit,* 49 *fluid ounces. Dissolve.*

This is one-fifth the strength of the preparation of the same name in the British Pharmacopœia of 1864.

Dose.—Of powdered nutmeg, ten to thirty grains; of the volatile oil, one to five drops on sugar, or dissolved in spirit. It is added as a corrigent to aperients, as in the pill of socotrine aloes. Of the spirit, one-half to one fluid drachm. The concrete oil is employed only as an external application, as in the pitch and warm plasters.

Nutmegs and mace are both used as stimulating and flavouring condiments or spices. Medicinally, the volatile oil and the spirit are used as carminative and flavouring adjuncts to other remedies, and they act of themselves as mild aromatic stimulants. Externally, they operate as topical stimulants, and the fixed oil has been thus used in chronic rheumatism and other local pains, and in paralysis.

THYMELACEÆ—The Mezereon Order.—Shrubby plants, generally distributed. The plants possess acrid, irritant, and occasionally narcotic properties. Officinal plant: *Daphne Mezereum, D. Laureola.*

Mezerei Cortex—Mezereon Bark.—Officinal plants:—1. *Daphne Mezereum,* Linn.; *Octandria Monogynia;* Mezereon. Illustration, plate 65, *Steph. and Church. Med. Bot.* 2. *Daphne Laureola,* Linn.; Spurge Laurel. Illustration, plate, 119, vol. ii., *Eng. Bot.* Officinal part: The bark, dried. Officinal preparations: *Extractum Mezerei Æthereum;* enters into *Decoctum Sarsæ Compositum, and Linimentum Sinapis Compositum.*

Botany.—Daphne Mezereum is a small shrub, with lanceolate, smooth, evergreen, deciduous leaves; pale, rose-coloured, fragrant flowers, arranged in a spike-like manner, and appearing before the leaves; and a bright-red, fleshy, one-seeded berry. *Daphne Laureola* has a smooth, erect stem, one to three feet high; lanceolate, glabrous, evergreen leaves; green flowers arranged in axillary racemes; and an oval bluish-black berry. *Habitat,* indigenous.

Characters of the Bark.—*In strips or quilled pieces of various lengths, tough and pliable, olive-brown on the surface, white within, fibrous, odour faintly nauseous, taste hot and acrid.*

Extractum Mezerei Æthereum, Ethereal Extract of Mezereon.

Preparation.—*Take of mezereon bark, cut small,* 1 *pound; rectified spirit,* 8 *pints; ether,* 1 *pint. Macerate the mezereon in six pints of the spirit for three days, with frequent agitation. Strain and press. To the residue of the mezereon add the remainder of the spirit, and again macerate for three days, with frequent agitation. Strain and press. Mix and filter the strained liquors. Recover the greater part of the spirit by distillation. Evaporate what remains to the consistence of a soft extract. Put this into a stoppered bottle with the ether, and macerate for twenty-four hours, shaking them frequently. Decant the ethereal solution. Recover part of the ether by distillation, and evaporate what remains to the consistence of a soft extract.*

This extract is greenish or greenish-brown, and has been adopted from the Prussian Pharmacopœia. It is used in the preparation of Linimentum Sinapis Compositum, on account of its stimulating properties.

The barks of the stem and root are the most active, and are very acrid. Besides other constituents, the bark contains an acrid resin and an acrid volatile oil, to both of which its properties are due, and a neutral crystalline principle, termed *Daphnin.*

Mezereon acts in over-doses as an acrid poison, and topically as a powerful irritant, the bark causing vesication when moistened and bound upon the skin. Internally, it acts as a stimulating diaphoretic and alterative, and is useful in rheumatic and venereal diseases. It is seldom given alone, but enters into the compound decoction of sarsaparilla. A few grains of the bark chewed act as a masticatory.

Santalaceæ—The Sandal Wood Order.—Trees, shrubs, or herbs, met with in Europe, Asia, America, and Australia. The wood of many of the trees is fragrant, and from one of them is obtained an oil which is now used in medicine.—*Oil of Yellow Sandal Wood* is obtained by distillation from the wood of the tree *Santalum myrtifolium* (syn., *S. album, S. verum,* and *Sirium myrtifolium*). It has recently been employed as a substitute for copaiva and cubebs in the treatment of gonorrhœa. It is given in doses of twenty to forty minims, diluted with three parts of rectified spirit, three times a-day, and is found to give highly satisfactory results.

ARISTOLOCHIACEÆ—The Birthwort Order.—Herbs or climbing shrubby plants, widely distributed, but chiefly in tropical South America. The plants possess pungent, aromatic, stimulant, and tonic properties. Officinal plant: *Aristolochia Serpentaria.*

Serpentariæ Radix—Serpentary Root,—Officinal plant: *Aristolochia Serpentaria,* Linn.; *Gynandria Hexandria*; Virginian Snake Root. Illustration, plate 180, *Steph. and Church. Med. Bot.* Officinal part: The dried rhizome; from the southern parts of North America. Officinal preparations: *Infusum Serpentariæ, Tinctura Serpentariæ*; enters into *Tinctura Cinchonæ Composita.*

Botany.—*Rootstock,* perennial, roundish, with numerous root-fibres. *Stems,* herbaceous, simple, eight to ten inches high, slender, flexuous. *Leaves,* alternate, cordate, acuminate, pubescent. *Flowers,* solitary, reddish-brown. *Habitat,* North America.

CHARACTERS.—*A small roundish rhizome, with a tuft of numerous slender rootlets, about three inches long, yellowish, of an agreeable camphoraceous odour, and a warm, bitter, camphoraceous taste.*

Serpentary contains a volatile oil, bitter extractive, resin, &c., and yields its active principle both to water and alcohol.

INFUSUM SERPENTARIÆ—INFUSION OF SERPENTARY.—*Take of serpentary root, bruised,* $\frac{1}{4}$ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for two hours, and strain.*

TINCTURA SERPENTARIÆ—TINCTURE OF SERPENTARY.—*Take of serpentary root, in coarse powder,* $2\frac{1}{2}$ *ounces; proof spirit,* 1 *pint. Macerate the serpentary for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of the spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—In powder (ineligible), ten to thirty grains ; of the infusion, one to two fluid ounces ; of the tincture, one to two fluid drachms.

Serpentary was formerly a good deal used in this country, and is still largely employed in America, as a general stimulant in debilitating and depressing diseases, but it is scarcely at all used here now. It was also employed as a tonic and emmenagogue, and as an antidote to the bites of the rattlesnake and rabid dogs.

EUPHORBIACEÆ—The Spurgewort Order.—Trees, shrubs, or herbs, occasionally in North America, Africa, India, and Europe ; abounding in Equinoctial America. The plants furnish a milky juice, a starchy matter, oils, and caoutchouc. They are generally acrid and poisonous. Officinal plants : *Croton Eluteria, Croton Tiglium, Ricinus communis, Rottlera tinctoria.*

Cascarillae Cortex—Cascarilla Bark.—Officinal plant : *Croton Eluteria,* Bennett ; *Monœcia Monadelphia;* Bahama Cascarilla. Illustration, plate 1, p. 150, vol. iv., *Pharm. Journ.* 2nd ser. Officinal part : The bark ; from the Bahama Islands. Officinal preparations : *Infusum Cascarillæ, Tinctura Cascarillæ.*

Botany.—A small tree, three to five feet in height, with angular, compressed, striated, downy branches and twigs. *Leaves,* alternate, two or three inches long, stalked, ovate, scanty. *Inflorescence,* axillary, terminal, branched racemes ; flowers, white and fragrant. *Habitat,* Bahama Islands, especially in the island of Eleuthera, whence its specific name.

CHARACTERS OF THE BARK.—*In quills, two or three inches in length, and from two to five lines in diameter, dull brown, but more or less coated with white crustaceous lichens; breaks with a short resinous fracture; is warm and bitter to the taste; and emits a fragrant odour when burned.*

Besides other constituents, the bark contains a bitter crystallisable principle termed *Cascarillin,* a volatile oil, resin, red colouring matter, &c. Copalchi and grey or Huanuco barks may be mistaken for cascarilla ; the true bark is in short pieces, somewhat twisted, more or less quilled, the quills varying from the thickness of a pencil to that of the little finger, and much fissured. The bark yields its active principles, cascarillin and volatile oil, to spirit, and partially to water.

INFUSUM CASCARILLÆ—INFUSION OF CASCARILLA.—*Take of cascarilla bark, in coarse powder,* 1 *ounce ; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain.*

TINCTURA CASCARILLÆ—TINCTURE OF CASCARILLA.—*Take of cascarilla bark, bruised,* 2½ *ounces ; proof spirit,* 1 *pint. Macerate the cascarilla for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally ; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of the powdered bark, ten to thirty grains ; of the infusion,

one to three fluid ounces ; of the tincture, thirty minims to two fluid drachms.

Cascarilla acts as a non-astringent aromatic bitter tonic. It has been proposed as a substitute for cinchona bark as a tonic and febrifuge. Its preparations are commonly used as aromatic and tonic adjuncts to other medicines in atonic dyspepsia, in convalescence from exhausting diseases, in chronic bronchial complaints, in chronic diarrhœa and dysentery, &c.

Oleum Crotonis—Croton Oil.—Officinal plant : *Croton Tiglium*, Linn. ; *Monœcia Monadelphia ;* Croton Oil Plant. Illustration, plate 4, *Steph. and Church. Med. Bot.* Officinal plant : The oil, expressed from the seeds. Officinal preparation : *Linimentum Crotonis.*

Botany.—A small tree, fifteen to twenty feet high, with a smooth ash-coloured bark, and the young branches round and smooth. *Leaves*, oval, oblong, acuminate, thin, membranous, with two flat round glands at the base. *Inflorescence,* simple, erect, terminal racemes ; flowers, white. *Fruit,* oblong, obtusely triangular, size of a hazel nut ; three cells, each with a solitary seed. *Habitat,* India, Indian Archipelago, and Ceylon.

CHARACTERS.—*Slightly viscid; colour brownish-yellow, taste acrid, odour faintly nauseous.*

PURITY TESTS.—*Agitated with its own volume of alcohol, and gently heated, it forms a clear solution, from which about three-fourths of the oil separate on cooling.*

Croton Seeds are oval, about six lines in length, three in thickness, and three or four in breadth ; externally, they are of a brownish-black colour, more or less mottled, by the removal of portions of the outer covering or testa. The seeds are inodorous, but their taste, though at first mild and oleaginous, becomes acrid and burning. They contain a pale yellowish-white oily albumen, which surrounds the embryo. Croton Oil (*Oleum Tiglii*) is obtained by bruising the kernels, and subjecting them to pressure. In addition to other constituents, the oil contains *Crotonic acid,* which was formerly supposed to be its active principle, but the researches of Dr Pereira and Mr Redwood lead to the supposition that it is inactive ; it is held dissolved in a bland fixed oil. Croton oil is liable to adulteration with castor oil, which is soluble in alcohol ; and if the croton oil were insoluble, the two might be separated, as indicated in the purity test ; but practically the English croton oil is soluble in alcohol, and will not separate from it when agitated and heated with it, unless artificial cold be employed. The croton oil prepared in India, when agitated with alcohol, assumes a milky appearance, which is dissipated by a gentle heat. This variety is subject to adulteration with *Jatropha Oil.*

LINIMENTUM CROTONIS—LINIMENT OF CROTON OIL.—*Take of croton oil,* 1 *fluid ounce; oil of cajuput; rectified spirit, of each,* 3½ *fluid ounces. Mix.*

Dose.—One, two, or three drops, in the form of pill, made with confection of roses ; or it may be given in divided doses with other purgatives in the pill form ; it is sometimes necessary to give it in the liquid form, as in coma, and other conditions, in which the patient cannot be made

to swallow; it is then mixed with syrup or other vehicle, and placed at the back of the mouth; but when given in the liquid form, it causes a painful acrid sensation in the throat, which is objectionable. The liniment rubbed upon the skin produces redness and inflammation, followed by a copious pustular eruption.

Antidotes.—Empty the stomach promptly; demulcents; opium to check catharsis; treat inflammatory symptoms as they arise; give stimulants if the vital depression appears to demand them. Lime or lemon juice is said to afford instant relief when its action as a medicine is too violent; and alkalies are said to diminish its acridity without interfering with its catharic effect.

Croton oil in over-doses acts as an irritant poison. In medicinal doses it is a prompt drastic cathartic, operating freely in an hour or two after its administration. It occasionally fails, but it usually procures several watery evacuations, and causes considerable depression of the vital powers. It is employed as an internal remedy in those cases in which an immediate action of the bowels is imperative, and in cases in which, from inability or obstinate refusal to swallow, the patient is unable or unwilling to take a solid drug, or one in any form in large quantity. It is given to overcome obstinate constipation, in dropsies, in nervous diseases, and to act as a derivative in head cases. Although so powerful a purgative, it does not frequently cause nausea or griping, but in some cases it produces severe hyper-catharsis, and has been known to induce intussusception of the bowels. It is uncertain in its action, sometimes operating severely in small doses, at other times very slightly even when given in full doses. In consequence of its acrid and depressing qualities, it is contra-indicated in inflammatory affections of the alimentary canal and in cases of debility. When rubbed upon the skin, croton oil produces redness and inflammation, followed by a pustular eruption; it operates, therefore, as a counter-irritant, and is useful in a variety of inflammatory affections of internal organs. When rubbed upon the abdomen it sometimes produces its purgative effects. When applied externally, it occasionally produces an erysipelatous inflammation, and it is better not to apply it to exposed parts, such as the face and neck.

Oleum Ricini—Castor Oil.—Officinal plant: *Ricinus communis*, Linn.; *Monœcia Polyadelphia;* Castor Oil Plant. Illustration, plate 2209, *Bot. Mag.* Officinal part: The oil, expressed from the seeds, or imported; chiefly from Calcutta. It enters into the compound calomel pill.

Botany.—Either an herbaceous annual or an arborescent perennial, according to climate. *Root,* perennial or annual, long, thick, and fibrous. *Stems,* either herbaceous, and three or four feet high, or perennial, arbores-

cent, and fifteen to twenty feet high. *Leaves,* alternate, palmato-peltate, on long purplish, tapering petioles, with glands at the apex of the stalk. *Inflorescence,* terminal panicles; flowers glaucous, the lower male, the upper female. *Fruit,* a three-celled prickly capsule, with one seed in each cell. The seeds are oval, about four lines long, three lines broad, and a line and a-half thick; they are externally pale grey, marbled with darker spots and stripes. The seed-coat is smooth, thin, coriaceous, and divisible into two layers, an outer testa, comparatively thick and hard, and an internal membrane. At the upper end of the seed is the fleshy tumid body termed the *strophiole.* The nucleus of the seed is large, fleshy, and oleaginous, and consists of albumen, in which is imbedded the large leafy embryo. *Habitat,* India; cultivated elsewhere.

CHARACTERS OF THE OIL.—*Viscid, colourless, or pale straw-yellow, having a slightly nauseous odour, and a somewhat acrid taste.*

PURITY TESTS.—*Entirely soluble in one volume of alcohol, and in two volumes of rectified spirit.*

The seeds yield about one-third of their weight of oil, or rather less, about twenty-five to thirty per cent. Two kinds of seed are recognised, a large and a small kind, the latter yielding the most oil, and that of better quality. Castor oil is chiefly imported from the East Indies and from America; it is also obtained from the West Indies, and some is prepared in this country. When it is obtained by simple expression, it is termed *cold drawn* castor oil, and that is the finer variety; but more or less heat is often applied, and in some instances it is obtained by making an aqueous decoction of the bruised seeds, and collecting the oil as it floats on the surface. The purer kinds of oil are pale yellow, and have a disagreeable, tenacious oily taste and unpleasant odour; the inferior kinds are darker in colour, and still more offensive in odour and taste. Castor oil is soluble in ether and in cold alcohol; when exposed to the atmosphere it thickens and congeals, without becoming opaque, but it turns rancid by the exposure. It is said to be made up of ricinoleine (which consists of ricinoleic acid ($C_{18}H_{34}O_2$), in combination with glycerine), and an acrid resin. Castor oil may be rancid and acrid, either from faulty preparation or from being carelessly kept, but it is seldom adulterated. The Pharmacopœial test is scarcely a sufficient guarantee of its purity; because, although other fixed oils (except English croton oil and concrete palm oil) are not soluble in cold alcohol alone, there are several which are rendered soluble by the presence of castor oil, and which, therefore, if mixed with it, would be dissolved along with it.

Dose.—From one or two fluid drachms for an infant, to one or two fluid ounces for an adult. It may be given either alone, or as an emulsion with yolk of egg or mucilage, or in warm milk, coffee, aromatic water, &c. It should always be gently warmed before it is taken.

Castor oil acts as a mild non-stimulating purgative, and produces its effects by whatever channel it is introduced into the system, whether by the mouth, the rectum, or by injection into a vein. It causes little or no constitutional disturbance, and therefore is useful as a laxative after surgical operations, after parturition, in inflam-

matory affections of the abdominal and pelvic viscera, and in other circumstances in which repose is imperative. It is a safe remedy for children and debilitated persons, as it does not cause much depression nor irritation, unless it be rancid, when it may, from its acridity, give rise to severe diarrhœa. There are many persons, however, who cannot tolerate castor oil in any form, even when most skilfully disguised.

Kamala—Kamala.—Officinal plant: *Rottlera tinctoria,* Roxb.; *Diœcia Polyandria.* Illustration, *Roxb. Crom.*, plate 168. Officinal part: A powder which consists of the minute glands which cover the capsules; imported from India.

Botany.—A small tree, from ten to twenty feet in height. *Leaves,* alternate, entire, oblong, pointed. *Inflorescence,* terminal panicles; flowers diœcious. *Fruit,* capsular, tricoccous, roundish, about the size of a pea or small cherry, and covered with minute, sessile, roundish, semi-transparent glands of a bright-red colour. *Habitat,* India, Ceylon, China, &c.

CHARACTERS.—*A fine granular mobile powder, of a brick-red colour; it is with difficulty mixed with water, but when boiled with alcohol, the greater part is dissolved, forming a red solution.*

PURITY TESTS.—*Ether dissolves most of it; the residue consisting principally of tufted hairs. It should be free from sand or earthy impurities.*

Kamala occurs as a brick-red powder, which, when examined microscopically, is found to consist of roundish, semi-transparent granules, of one two-hundred and fiftieth to one five-hundredth of an inch in diameter, mixed with stellate hairs. It has but little odour or taste, is scarcely soluble in boiling, and not at all in cold water, but forms a deep red solution with alkalies, and is soluble in ether and in alcohol. It contains, besides other constituents, a peculiar yellow crystalline principle, termed *Rottlerin,* which may be separated by ether along with the resinous colouring matter.

Dose.—From thirty to one hundred and eighty grains, mixed with honey or treacle. A tincture, made by macerating eight ounces of the powder in twenty fluid ounces of rectified spirit, may be given in doses of one to four fluid drachms.

Kamala is employed in India under the names of *Kamala, Reroo,* and *Wurrus,* both as a dye-stuff and as a vermifuge. It has not yet been much employed in this country. It acts as a prompt purgative, causing more or less of nausea and griping; but its chief medicinal value resides in its vermifuge properties, on account of which it is employed for the removal of tænia solium. To persons of weakly condition rather a small dose should be given, as it is apt to purge frequently.

EUPHORBIUM.—Euphorbium is the concrete resinous juice of an undetermined species of Euphorbia. It is produced in Western Africa,

and in the Canary Islands, in the former situation probably by *Euphorbia officinarum,* and other species, in the latter by *Euphorbia canariensis.* It is obtained by making incisions into the stem and branches of the tree, from which it exudes as a milky juice ; it is allowed to concrete before it is removed, and the pieces are usually pierced with one or two holes produced by the prickles of the plant, around which they had dried. Euphorbium occurs in dull yellowish-white friable tears of irregular shape and size; it is nearly inodorous, but has an acrid burning taste, and the powder or dust, when brought into contact with the nose and eyes, causes great irritation and violent sneezing ; during the process of powdering it, as well as in gathering it from the tree, it is necessary to protect the face. Euphorbium contains about sixty per cent. of an acrid resin, which is its active ingredient, besides wax and other substances. It melts when heated, burns with a pale flame, emitting a rather fragrant odour. The resin is soluble in alcohol and in ether. Euphorbium is rarely employed internally ; it acts as a dangerous acrid cathartic and emetic, and was formerly used in nervous diseases ; externally, it acts as a powerful irritant and rubefacient, and has been employed as an issue ointment, of the strength of twenty to twenty-five grains of the powder to an ounce of lard.

TAPIOCA.—Fecula of the root of *Janipha Manihot,* Humb. and Bonpl. ; (*Jatropha Manihot,* Linn. ; *Manihot utilissima Pohl.*) The root of the *Manioc* or *Bitter Cassava* plant, abounds in a poisonous milky juice, which is rendered innocuous by heat. When the root is beaten into a pulpy mass, washed with water, and pressed upon mat sieves, the acrid juice and the fecula pass through into vessels beneath, whilst the mealy substance which remains behind, when baked into cakes on an iron plate, constitutes *Cassava bread.* The fecula, after it has separated by subsidence from the juice, is dried upon heated plates, assumes a granular form, and constitutes the *Tapioca* of commerce. The fresh root acts as a violent irritant poison, producing delirium and convulsions ; but when the juice is boiled, as in the preparation of soup, it becomes harmless. Tapioca occurs in white, inodorous, tasteless, and irregular grains. It is a pure form of starch. Tapioca is used as a bland non-stimulating article of diet, suitable to invalids and children. The fresh root, scraped, and made into a poultice, is occasionally used in India as a topical application, but it is not without danger. The root of *Sweet Cassava* is used as a vegetable, and also to a large extent in the preparation of *Piwarry,* a fermented and intoxicating liquor, used by the Indians.

URTICACEÆ—The Nettle and Hemp Order.—Trees, shrubs, or herbs. The order is divided into two sub-orders :—1. *Urticeæ,* Nettleworts, the true Nettles, which are universally distributed ; and 2. *Cannabineæ,* Hempworts, the Hemp and Hop tribe, natives chiefly of temperate regions. The plants possess tonic, narcotic, and other properties. Officinal plants : *Humulus Lupulus, Cannabis sativa,* both belonging to the sub-order *Cannabineæ.*

Lupulus—Hop.—Officinal plant : *Humulus Lupulus,* Linn. ; *Diœcia Pentandria ;* the Hop. Illustration, plate 41, *Steph. and Church. Med. Bot.* Officinal part : The dried strobiles of the female plant ; cultivated in England. Officinal preparations : *Extractum Lupuli, Infusum Lupuli, Tinctura Lupuli.*

Botany.—*Root,* perennial. *Stems,* annual, long, weak, pliable, climbing, scabrous. *Leaves,* opposite, on long, often winding petioles, three to five-lobed, sharply serrated, rough. *Flowers,* numerous, diœcious, greenish-yellow ; male flowers in loose panicles, female flowers in catkins or strobiles, male and female flowers on separate plants. *Habitat,* indigenous, various parts of Europe, cultivated in the south of England.

CHARACTERS.—*Strobiles of a greenish-yellow colour, with minute yellow grains (Lupuline) adherent to the base of the scales. Odour aromatic, taste bitter.*

The scales of the catkin are thin, membranous, veined, and covered with numerous superficial yellow, shining, roundish glands, which are variously termed *lupulinic grains* or *glands, lupulin* or *yellow powder.* Hops have an agreeable odour, and a bitter taste, produced by the glands. The catkins are gathered in September, and dried in kilns. The glands contain, beside other ingredients, a volatile oil, and a bitter principle termed *lupulite,* and resin. The volatile oil, according to Personne, is chemically analogous to oil of valerian. The scales contain tannin.

EXTRACTUM LUPULI—EXTRACT OF HOP.—*Take of hop,* 1 *pound; rectified spirit,* 1½ *pint; distilled water,* 1 *gallon. Macerate the hop in the spirit for seven days, press out the tincture, filter, and distil off the spirit, leaving a soft extract. Boil the residual hop with the water for one hour, press out the liquor, strain, and evaporate by a water-bath to the consistence of a soft extract. Mix the two extracts, and evaporate at a temperature not exceeding* 140°, *until it has acquired a suitable consistence for forming pills.*

INFUSION LUPULI—INFUSION OF HOP.—*Take of hop,* ½ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for two hours, and strain.*

TINCTURA LUPULI—TINCTURE OF HOP.—*Take of hop,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the hop for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of Lupulin (the yellow powder, lupulinic grains or glands) separated from the scales by rubbing and sifting, five to ten or twelve grains in powder or pill. Of the extract, five to twenty grains ; of the infusion, one to two or more fluid ounces ; of the tincture, one to two or three fluid drachms.

The aroma of hops is said to act as a narcotic, and in order to procure this effect, in certain cases of nervous restlessness, or maniacal watchfulness and insomnia, the patient is made to rest the head upon a pillow stuffed with the catkins. As an internal remedy, hops are probably not narcotic. Lupulin is said to be somewhat of a narcotic and anodyne. The officinal preparations act as mild aromatic tonics and stomachics. Hops and their preparations have been used both internally and by local application, to

procure sleep or to relieve pain, in mania, in delirium, in rheumatism, in cancer, in painful tumours and ulcerations, in dyspepsia, in gouty spasm of the stomach, &c. Lupulin has been tried in intermittent fever.

Cannabis Indica—Indian Hemp.—Officinal plant: *Cannabis sativa*, Linn.; *Diœcia Pentandria;* Hemp. Illustration, plate 61, vol. x. *Rheede, Hort. Malab.* Officinal part: The flowering tops of the female plant from which the resin has not been removed, dried; cultivated in India. Officinal preparations: *Extractum Cannabis Indicæ, Tinctura Cannabis Indicæ.*

Botany.—An annual, generally diœcious. *Root*, white, fusiform. *Stem*, three to six or more feet high, erect, simple when crowded, branched when growing apart, angular, pubescent. *Leaves*, on long weak petioles, opposite or alternate, digitate, scabrous; leaflets, five to seven, narrow, lanceolate, sharply serrated. *Stipules*, subulate. *Inflorescence*, males, racemose; females in spikes. *Fruit*, ovate, one-celled, with a solitary seed. Cultivated in India.

Characters.—*Tops consisting of one or more alternate branches, bearing the remains of the flowers and smaller leaves, and a few ripe fruits, pressed together in masses, which are about two inches long, harsh, of a dusky-green colour, and a characteristic odour.*

Cannabis indica occurs in three forms, *Gunjah, Churrus*, and *Bang. Gunjah* is the entire plant, cut during inflorescence, with the resin carefully preserved on the leaves; it is exposed to the sun for three days, and then made into bundles about two feet long, each containing twenty-four plants. *Churrus* consists simply of the resin obtained from the leaves, slender stems, and flowers. It is obtained in different ways: either by rubbing the leaves carefully between the palms of the hands and scraping the soft resin from them when enough has adhered; by rubbing the leaves gently with a cloth, and scraping the resin off it. *Bang* consists of a mixture of the leaves and capsules without the stalks. The active principle of the plant is the resin, sometimes called *Cannabin;* there is also a small quantity of volatile oil. The resin is of dark green colour, has a fragrant odour, a warm, acrid, and bitter taste, and is soluble in alcohol and in ether, and in the fixed and volatile oils.

EXTRACTUM CANNABIS INDICÆ — Extract of Indian Hemp.—*Take of Indian hemp, in coarse powder,* 1 *pound; rectified spirit,* 4 *pints. Macerate the hemp in the spirit for seven days, and press out the tincture. Distil off the greater part of the spirit, and evaporate what remains by a water-bath, to the consistence of a soft extract.*

TINCTURA CANNABIS INDICÆ—Tincture of Indian Hemp.—*Take of extract of Indian hemp,* 1 *ounce; rectified spirit,* 1 *pint. Dissolve the extract of hemp in the spirit.*

Dose.—Of the extract, half-a-grain to a grain, cautiously increased to four or five grains, according to the purity of the drug and the condition of the patient. Of the tincture, ten minims, cautiously increased to a fluid drachm, repeated at short intervals until the desired effects are pro-

duced. When administered in an aqueous vehicle, it requires mucilage to suspend it. The effects must be carefully watched.

Indian hemp is employed by the natives for the purpose of intoxication. Taken thus in large doses, it quickens the circulation and exhilarates the spirits, producing a kind of mirthful or extravagant delirium, during which its victim alternately laughs, cries, sings, dances, or craves for food, all the while believing himself to be in a normal state of mind. Sometimes, however, it makes its victim ill-tempered, violent, and pugnacious. It usually produces an inordinate appetite for food, and acts powerfully as an aphrodisiac. In medicinal doses it acts upon the cerebro-spinal system, causing, in moderate doses, exhilaration of spirits, a kind of inebriation and hallucination, followed by confusion of intellect and tendency to sleep ; in large doses it causes stupor. After the primary effects of a full dose have passed off, the patient is said to be left in a state of catalepsy. *Cannabis indica* has been most frequently used in this country as a substitute for opium in cases in which the latter is not tolerated. It differs from opium in its effects, chiefly in not contracting the pupil, and in not causing loss of appetite, dry tongue, or constipation. The great drawback to its employment is its exceeding uncertainty of action, small doses in some cases causing marked symptoms, whilst in other instances full doses produce no effect, circumstances which depend, however, a good deal upon the purity of the drug. *Cannabis indica* has been used as an anodyne, hypnotic, antispasmodic, nervine stimulant, &c., and has been employed in tetanus, hydrophobia, chorea, infantile convulsions, delirium tremens, various forms of neuralgia, in headache with dull throbbing pain over one brow, usually the right one, gout, rheumatism, in low fevers, in hysteria, in asthma, in palpitation of the heart, in menorrhagia, in protracted labour depending upon an atonic state of the uterus, &c. It is contra-indicated in active inflammatory states, and the patient must be carefully watched during its exhibition, lest he should injure himself whilst mentally incapacitated by it, as sometimes happens. Antimonials, salines, a blister to the nape of the neck, &c., may be employed to control its violent action.

ARTOCARPACEÆ—The Bread-fruit or Mulberry Order. Trees or shrubs. The order is divided into two sub-orders :—1. *Artocarpeæ,* the Bread-fruit tribe, natives of the tropics. 2. *Moreæ,* the Mulberry and fig tribe, inhabiting tropical and temperate climates. Many of the plants of the order furnish edible fruits ; they possess bitter, tonic,

acrid, and poisonous properties. Officinal plants: *Morus nigra, Ficus carica.*

Mori Succus—Mulberry Juice.—Officinal plant: *Morus nigra,* Linn.; *Monœcia Tetrandria;* the common Mulberry. Illustration, plate 29, *Steph. and Church. Med. Bot.* Officinal part: The juice of the ripe fruit. Officinal preparation: *Syrupus Mori.*

Botany.—A tree, twenty to thirty feet high. *Leaves,* alternate, cordate, lobed, coarsely serrated, pubescent. *Flowers,* greenish, monœcious; male flowers in spikes; female flowers in small roundish or ovoid catkins. *Fruit,* dark purple, formed by the female flowers becoming fleshy and coherent, and including a dry membranous one-seeded pericarp. *Habitat,* Persia and China; cultivated in Britain.

Characters of the Juice.—*Of a dark violet colour, with a faint odour, and an acidulous sweet taste.*

SYRUPUS MORI—Syrup of Mulberries.—*Take of mulberry juice,* 1 *pint; refined sugar,* 2 *pounds; rectified spirit,* 2½ *fluid ounces. Heat the mulberry juice to the boiling point, and when it has cooled filter it. Dissolve the sugar in the filtered liquid with a gentle heat, and add the spirit. The product should weigh three pounds six ounces, and should have the specific gravity* 1·33.

Dose.—Ad libitum, or *q.s.*

Mulberry juice is occasionally used as a refrigerant; in large doses it is laxative. The syrup is used to impart colour and flavour.

Ficus—Fig.—Officinal plant: *Ficus Carica,* Linn.; *Polygamia Triœcia*; The Fig Tree. Illustration, plate 154, *Steph. and Church. Med. Bot.* Officinal part: The dried fruit, imported from Smyrna. Enters into confection of senna.

Botany.—A small tree. *Leaves,* large, cordate, palmate, scabrous above, pubescent beneath. *Flowers,* monœcious, numerous, pedicellated, inclosed within a pear-shaped fleshy receptacle, which is umbilicated, nearly closed at the apex, and hollow; utricle single, sunk into the pulpy receptacle. *Habitat,* Asia. Cultivated in the south of Europe, &c.

Characters.—*Compressed, soft but tough, brown, covered with a saccharine efflorescence, containing a viscid sweet pulp, and numerous small hard seeds.*

Figs act as emollients and demulcents, and in large quantity as laxatives. They are largely used as a dessert; they form an ingredient of confection of senna, and when split and toasted, they are occasionally used as a topical application to gum-boils.

The root of *Dorstenia Contrayerva* acts as a mild aromatic stimulant, tonic, and diaphoretic.

ULMACEÆ—The Elm Order.—Trees or shrubs, inhabiting northern countries. The plants possess bitter and astringent properties. Officinal plant: *Ulmus campestris.*

Ulmi Cortex—Elm Bark.—Officinal plant: *Ulmus campestris,* Linn.; *Pentandria Digynia;* The Broad-leaved Elm. Illustration, plate 197, *Woodv. Med. Bot.* Officinal part: The dried inner bark, deprived of its outer layers; from trees indigenous to and cultivated in Britain. Officinal preparation: *Decoctum ulmi.*

Botany.—A tree of sixty to eighty feet in height, with a rugged bark. *Leaves,* alternate, broadly ovate, oblique at the base, scabrous above and pubescent beneath. *Flowers,* hermaphrodite, in dense heads, reddish-brown. *Habitat,* indigenous.

CHARACTERS.—*A tough brownish-yellow bark, about half-a-line thick, without smell; taste mucilaginous, slightly bitter and astringent. Its decoction is turned green by perchloride of iron, and precipitates with a solution of gelatine.*

The bark contains tannin, and a mucilaginous or gummy principle termed *Ulmin,* which is brown, and insoluble in water.

DECOCTUM ULMI.—Decoction of Elm Bark.

PREPARATION.—*Take of elm bark cut in small pieces,* $2\frac{1}{2}$ *ounces; distilled water,* 1 *pint; boil for ten minutes in a covered vessel, then strain and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.*

The decoction is the only officinal preparation of elm bark. It is the usual form of administering it. Elm bark is employed as an astringent and demulcent tonic and alterative, but chiefly for the sake of its action upon the skin. It is given in the chronic scaly skin-diseases of debilitated persons, especially in ichthyosis, in which it is sometimes employed as a cheap substitute for sarsaparilla. It should be given in doses of from two to four fluid ounces.

PIPERACEÆ—The Pepper Order.—Shrubs or herbs, natives of tropical regions. The plants of this order contain an acrid resin, a volatile oil, and a crystalline substance; they possess pungent, aromatic, astringent, and narcotic properties. Officinal plants: *Piper nigrum, Cubeba officinalis, Artanthe elongata.*

Piper Nigrum—Black Pepper.—Officinal plant: *Piper nigrum,* Linn.; *Diandria Trigynia;* The Black Pepper. Illustration, plate 187, *Woodv. Med. Bot.* Officinal part: The dried unripe berries; chiefly from the East Indies. Officinal preparation: *Confectio Piperis.* It enters also into *Confectio Opii* and *Pulvis Opii Compositus.*

Botany.—Perennial. *Stem,* eight to twelve feet long, round, flexuose, trailing or climbing, jointed, dichotomously branched. *Leaves,* broadly ovate or elliptical, acuminate, five to seven-nerved, dark green and glossy above, pale glaucous-green beneath. *Inflorescence,* spikes opposite the

leaves, shortly stalked, pendulous, three to six inches long. *Flowers*, unisexual or hermaphrodite, small, whitish. *Fruit*, distinct, baccate, about the size of a pea, one-seeded, at first green, then red, afterwards black, covered by pulp. *Habitat*, India and the Indian Archipelago; cultivated in the West Indies.

CHARACTERS. — *Small, roundish, wrinkled; tegument brownish-black, containing a greyish-yellow globular seed. Odour aromatic. Taste pungent and bitterish.*

The berries are gathered before they are quite ripe, and are dried in the sun. White pepper is derived from the same fruit, the berries being first allowed to ripen, and then decorticated. Black pepper contains, besides other ingredients, a peculiar neutral, crystalline principle, termed *Piperin*, which, when quite pure, occurs in colourless rhombic prisms, is tasteless and inodorous; but it is usually dark yellow and acrid, owing to the presence of volatile oil. The berries contain also a volatile oil, which has the odour and taste of the fruit, and an acrid resin.

CONFECTIO PIPERIS—CONFECTION OF PEPPER.—*Take of black pepper, in fine powder,* 2 *ounces; caraway fruit, in fine powder,* 3 *ounces; clarified honey,* 15 *ounces. Rub them well together in a mortar.*

Dose.—Of pepper, five to twenty grains; of piperin, three to five grains; of the confection, sixty to one hundred and twenty or more grains, twice or thrice a-day, continued for several months.

Pepper is largely used as a condiment. As a medicine, it acts as an acrid, aromatic, stimulant stomachic, and as a febrifuge. It acts also particularly upon the mucous membranes of the rectum and of the urinary organs. Externally, it acts as a rubefacient. It is useful as a stimulant stomachic condiment in atonic and torpid states of the stomach. It is given as a febrifuge in intermittent fever, a property which it owes to piperin, which may be given alone for that purpose. Pepper is also used as a masticatory in paralysis of the tongue, relaxed uvula, and other affections of the mouth. The confection is employed in diseases of the rectum, such as hæmorrhoids, fistula, ulcers, &c. In order to afford any benefit, it must be continued for two or three months. Pepper is contra-indicated in inflammatory conditions of the mucous membrane.

Piper Longum—Long Pepper.—The dried unripe spikes of *Piper longum* were formerly officinal. The spikes of the berries occur as hard, greyish, long, cylindrical bodies, from an inch to an inch and a-half in length, have a faint aromatic odour, and a strong pungent taste. Their composition is very nearly the same as that of black pepper, for which they may be used as a substitute.

Cubeba—Cubebs.—Officinal plant: *Cubeba officinalis*, Miquel; *Diandria Trigynia;* the Cubeb Pepper. Illustration, plate 175, *Steph. and Church. Med. Bot.* Officinal parts:—1. The unripe fruit, dried; culti-

vated in Java. 2. *Oleum Cubebæ,* Oil of Cubebs; the oil distilled in England from Cubebs. Officinal preparation: *Tinctura Cubebæ.*

Botany.—Stem, climbing. *Leaves,* stalked, oblong or ovate-oblong, acuminate, coriaceous. *Inflorescence,* solitary spike, opposite the leaves. *Flowers,* diœcious. *Fruit,* baccate, rather larger than black pepper. *Habitat,* Java.

CHARACTERS OF THE FRUIT. — *The size of black pepper, globular, wrinkled, blackish, supported on a stalk of rather more than its own length, has a warm, camphoraceous taste, and characteristic odour.*

CHARACTERS OF THE OIL.—*Colourless or pale greenish yellow, having the peculiar odour and taste of cubebs.*

TINCTURA CUBEBÆ—TINCTURE OF CUBEBS.—*Take of cubebs, in powder,* $2\frac{1}{2}$ *ounces; rectified spirit,* 1 *pint. Macerate the cubebs for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.*

Cubebs contain *a volatile oil,* which is obtained by grinding the fruit and distilling it with water; its density is 0·929; *a resin;* and *cubebin,* which is probably identical with piperin, and may be obtained in small acicular crystals.

Dose.—Of freshly-powdered cubebs, from ten or twenty up to one hundred and twenty or more grains, two or three times a-day. Of oil of cubebs, ten to fifteen mimims, raised to thirty or more, as the stomach will bear it, either suspended in mixture by mucilage, or dropped upon sugar. Of the tincture which has been adopted from the Dublin Pharmacopœia, one-half to one fluid drachm.

Cubebs, like common pepper, act as an acrid and stimulant stomachic; in over-doses they cause griping and purging, with considerable febrile excitement. They act upon the mucous membranes generally, but especially upon the genito-urinary tract. They are chiefly employed in the treatment of gonorrhœa, given in full doses at the early stage of the disease. They are also occasionally used in other affections of the urinary organs, such as leucorrhœa cystorrhœa, abscess of the prostate gland, &c.; and also in those affections of the pulmonary mucous membrane in which there is profuse secretion. Except in gonorrhœa, in which they are given in doses of sixty to a hundred and twenty or more grains, they should be given in moderate doses, as from ten to thirty grains. They are apt to produce a cutaneous eruption resembling urticaria.

Maticæ Folia—MATICO LEAVES.—Officinal plant: *Artanthe elongata,* Miquel.; *Diandria Monogynia;* The Matico Plant. Illustration, plate 57, *Ruiz. and Pavon. Flor. Peruv.* (*Piper angustifolium.*) Officinal

part: The dried leaves, imported from Peru. Officinal preparation: *Infusum Maticæ.*

Botany.—A shrub, ten to twelve feet high; stem and branches, jointed; inflorescence, solitary, cylindrical, spikes; habitat, Peru.

CHARACTERS OF THE LEAVES.—*From two to eight inches long, veined and tessellated on the upper surface, downy beneath, with an aromatic, slightly astringent, warm taste, and an agreeable aromatic odour.*

Matico occurs in bundles, consisting of dried leaves, stalks, and spikes. The leaves contain *a bitter principle* (*Maticine*), which is soluble in alcohol and in water; *an aromatic volatile oil*, which, when first deposited, is light green and transparent, but when kept becomes thick and crystalline; *a soft dark-green resin; a little tannin* and *artanthic acid.*

INFUSUM MATICÆ—INFUSION OF MATICO.—*Take of matico, cut small,* ½ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for half-an-hour, and strain.*

Dose.—Of powdered matico, ten to thirty or forty grains; of the infusion, one to four fluid ounces.

Matico acts as an aromatic bitter astringent stimulant and stomachic, and may be used internally in the same manner as the preparations of pepper and cubebs. As an internal remedy, its astringent properties are not well marked, and although it acts externally as a reliable hæmostatic, the effect is probably due rather to the mechanical action of the leaf than to astringency. It is given internally in affections of the bladder and rectum, for the same purposes as pepper and cubebs are given; but its chief use is as an external application to check bleeding from small wounds, such as leech-bites. The under surface of the leaf, from its reticulated texture, is said to be more efficacious as a hæmostatic than the upper.

Salicaceæ—The Willow Order.—Amentiferous trees or shrubs, chiefly inhabitants of northern regions, some in antarctic regions, and some at considerable elevations on the mountains of South America. Several species of willow have been used in medicine; the common varieties of this country are *Salix fragilis, S. alba,* and *S. caprœa,* crack, white, and sallow willows. *Salicis cortex*—willow bark—is usually met with in quills six or eight inches in length, with a smooth silver-grey epidermis, and a very bitter and slightly astringent taste. It contains, besides other constituents, tannic acid and a neutral non-nitrogenised principle termed Salicin. *Salicin* occurs in white silky acicular crystals or laminæ, and has a very bitter taste. It is soluble in water and in alcohol, but not in ether. Sulphuric acid produces with it a bright red colour. The willow bark, and its active principle salicin, act as tonics and febrifuges, and may be used as substitutes for cinchona bark and quinia, than which they are less powerful and less reliable. The bark may be given in the form of infusion or decoction, made of the strength of one ounce to a

pint of water, in doses of one or two fluid ounces; and salicin may be given in doses of one to three grains as a tonic; or five to twenty grains, or more, as a febrifuge. Salicin is a frequent adulteration of quinia. The reddening on addition of sulphuric acid readily detects its presence.

CORYLACEÆ or CUPULIFERÆ—The Hazel and Oak Order. —Amentiferous trees or shrubs, abounding in the forests of temperate regions. Officinal plant: *Quercus pedunculata.*

Quercus Cortex—Oak Bark—Officinal plant: *Quercus pedunculata,* Willd.; *Monœcia Polyandria;* The British Oak. Illustration, plate 126, *Wood. Med. Bot.* (*Q. Robur*). Officinal part: The dried bark of the small branches and young stems; collected in spring from trees growing in Britain. Officinal preparation: *Decoctum Quercus.*

Botany.—A handsome tree. *Leaves,* on short foot-stalks, cuneately oblong, pinnatifid, slightly pubescent beneath, deciduous. *Fruit,* two or three acorns upon a long peduncle. *Habitat,* indigenous.

Characters of the Bark.—*Covered with a greyish-shining epidermis, cinnamon-coloured on the inner surface, fibrous, brittle, and strongly astringent.*

The bark contains about fifteen per cent. of tannin, with gallic acid, and other constituents.

DECOCTUM QUERCUS—Decoction of Oak Bark.—*Take of oak bark, bruised,* $1\frac{1}{4}$ *ounce; distilled water,* 1 *pint. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.*

Dose.—Of the decoction, one to three fluid ounces.

Oak bark is used for the sake of its astringency, and is suitable for internal use, as a gargle, as an injection, and as a lotion, in diarrhœa, relaxed throat, leucorrhœa, flabby ulcers, &c.

Galla—Galls—Nutgalls.—Officinal plant: *Quercus infectoria,* Olivier; *Monœcia Polyandria;* The Gall Oak. Illustration, plate 152, *Steph. and Church. Med. Bot.* Officinal part: Excrescences caused by the punctures and deposited ova of *Diplolepis Gallæ tinctoriæ.* Officinal preparations: *Tinctura Gallæ, Unguentum Gallæ, Unguentum Gallæ cum Opio, Acidum Tannicum.*

Botany.—A small tree or shrub, four to eight feet high, with crooked stem; very smooth, shortly-stalked, ovate oblong, deciduous leaves, and a solitary obtuse acorn, two or three times longer than the cupule. *Habitat,* Asia Minor.

Characters.—*Hard heavy globular bodies varying in size from half-an-inch to three-fourths of an inch in diameter, tuberculated on the surface, the tubercles and intervening spaces smooth; of a bluish-green colour on the surface; yellowish-white within, with a small central cavity; intensely astringent.*

Galls, or Nutgalls, are produced by the female of the *Diplolepis Gallæ tinctoriæ,* which pierces, by means of her ovipositor, the buds and tender

parts of the branches and shoots of the tree, leaving her ova in the wound. The irritation produced by the foreign substance causes a flow of the juices of the plant towards the part, which soon forms an enlargement or excrescence, the gall of commerce. Within this excrescence the larva is developed, and as soon as the perfect insect is produced, it feeds upon the nucleus of the gall, and gradually eats its way out. Galls vary in size, weight, shape, and external appearance; they receive different names according to the country from which they are imported, as Levant Galls, Syrian Galls, Turkey Galls, Smyrna Galls, Aleppo Galls, &c.; but they are also named in accordance with their external appearance, as blue or green and white galls. Blue or green galls are the best; they vary in size from that of a pea to that of a hazel nut, and are perfect—that is, they still contain the insect. White galls are larger, paler, and less valuable, and generally present a small circular aperture produced by the insect in its escape. Besides these, other varieties are recognised, such as Large Mecca Galls, Dead Sea Apples or Mala Insana, &c. Nutgalls are inodorous, have a powerfully astringent taste, are easily powdered, and yield their properties to water, which is the best solvent, to proof spirit, and somewhat to alcohol and to ether. Galls contain tannin, gallic acid, ellagic and leuteogallic acids, extractive, mucilage, &c.

TINCTURA GALLÆ—TINCTURE OF GALLS.—*Take of galls, in coarse powder,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the galls for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of the spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

UNGUENTUM GALLÆ—OINTMENT OF GALLS.—*Take of galls, in fine powder,* 80 *grains; benzoated lard,* 1 *ounce. Mix thoroughly.*

UNGUENTUM GALLÆ CUM OPIO—OINTMENT OF GALLS AND OPIUM.—*Take of ointment of galls,* 1 *ounce; opium in powder,* 32 *grains. Mix thoroughly.*

Dose.—Of powdered galls, five or ten to twenty grains; it may be given in pills or mixture. Of the tincture, thirty minims to two fluid drachms. As an astringent gargle, lotion, or injection, an infusion or decoction of bruised galls may be used; or the tincture may be diluted with water. The ointments are chiefly used as topical applications to hæmorrhoids.

Galls are employed for the sake of their astringency in passive internal hæmorrhages, in chronic diarrhœa and dysentery, in profuse chronic mucous discharges, &c.; they are used as topical astringents in the form of gargle, lotion, wash, or injection; as antidotes, they are employed in poisoning by tartar emetic and the alkaloids. The ointments are employed chiefly as applications to hæmorrhoids.

Acidum Tannicum—Tannic Acid.—An acid, $C_{54}H_{22}O_{34}$, or $C_{27}H_{22}O_{17}$, obtained from galls. Officinal preparations: *Glycerinum Acidi Tannici, Suppositoria Acidi Tannici, Troschisci Acidi Tannici.*

PREPARATION.—*Take of galls in powder, and ether, of each a sufficient quantity. Expose the powdered galls to a damp atmosphere for two or three days, and afterwards add sufficient ether to form a soft paste. Let this stand in a well-closed vessel for twenty-four hours, then, having quickly enveloped it in a linen cloth, submit it to strong pressure in a suitable press, so as to separate the liquid portion. Reduce the pressed cake to powder, mix it with sufficient ether, to which one-sixteenth of its bulk of water has been added, to form again a soft paste, and press this as before. Mix the expressed liquids, and expose the mixture to spontaneous evaporation until, by the aid subsequently of a little heat, it has acquired the consistence of a soft extract; then place it on earthen plates or dishes, and dry it in a hot-air chamber at a temperature not exceeding* 212°.

Rationale.—The ether removes the tannic acid, leaving the other ingredients of the galls. Pure ether will scarcely dissolve tannic acid, but the solution of commercial ether in water consists of ether, alcohol, and water, and is a suitable solvent, as the ether does not dissolve the extractive of the galls.

CHARACTERS.—*In pale yellow vesicular masses or thin glistening scales, with a strongly astringent taste, and an acid reaction; readily soluble in water and rectified spirit, very sparingly soluble in ether.*

TESTS.—*The aqueous solution precipitates solution of gelatine yellowish-white, and the persalts of iron of a bluish-black colour. It leaves no residue when burned with free access of air.*

When quite pure, tannic acid is nearly white. When dry, it remains unchanged, but when moist, it absorbs oxygen, and is changed into gallic acid. It is inodorous. When heated in air, it melts and burns like a resin. With gelatine it forms a tannate, which is the basis of leather. It is not affected by the proto-salts of iron. The acid of commerce is usually sufficiently pure, and is not subjected to adulteration.

Glycerinum Acidi Tannici—Glycerine of Tannic Acid.

PREPARATION.—*Take of tannic acid,* 1 *ounce; glycerine,* 4 *fluid ounces. Rub them together in a mortar, then transfer the mixture to a porcelain dish, and apply a gentle heat until complete solution is effected.*

A useful external astringent, and forms an excellent application to chapped nipples and hands, and for relaxed and inflamed sore throat (in which case it should be painted over the throat with a camel-hair brush). It is also useful in muco-purulent discharges from the nose and the vagina. In the proportion of one part in seven of water it forms a good gargle.

SUPPOSITORIA ACIDI TANNICI—TANNIN SUPPOSITORIES.—*Take of tannic acid,* 36 *grains; benzoated lard,* 44 *grains; white wax,* 10 *grains; oil of theobroma,* 90 *grains. Melt the wax and oil of theobroma with a gentle heat, then add the tannic acid and benzoated lard, previously*

rubbed together in a mortar, and mix all the ingredients thoroughly. Pour the mixture while it is fluid into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository.

TROCHISCI ACIDI TANNICI—TANNIN LOZENGES—*Take of tannic acid,* 360 *grains; tincture of tolu,* $\frac{1}{2}$ *fluid ounce; refined sugar, in powder,* 25 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water,* 1 *fluid ounce. Dissolve the tannic acid in the water; add, first, the tincture of tolu, previously mixed with the mucilage, then the gum and the sugar, also previously well mixed. Form the whole into a proper mass; divide it into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains half-a-grain of tannic acid.*

Dose.—Of tannic acid, two or three to ten or more grains, in pill, or powder, or dissolved in water; for a gargle, lotion, or injection, five to ten grains to an ounce of water; or it may be made into an ointment. As a topical astringent to the throat, a lozenge may be taken occasionally, or the glycerine may be used; and as a topical application to the bowels, a suppository may be employed. Each suppository contains three grains of tannic acid.

Tannic acid acts as a powerful astringent, and is employed, both internally and externally, to arrest hemorrhages and chronic discharges, and to astringe relaxed tissues. It is employed in hemorrhages from the gums, nose, lungs, stomach, bowels, uterus, kidneys; in the night sweats and diarrhœa of phthisis; in chronic bronchial catarrh; in mucous and purulent discharges from the urinary organs, &c. As a topical agent, it is used to check the bleeding of slight wounds, as an application to weak discharging ulcers, as an injection in leucorrhœa, gonorrhœa, and gleet, as an application in prolapsus ani, hæmorrhoids, fissures of the rectum, &c. Also, as an application to certain discharging skin diseases, to sore nipples, in some affections of the eye, &c. It has been used internally also in dyspepsia, in certain nervous diseases associated with debility, in albuminuria, to check excessive vomiting after the use of ipecacuan, &c. Tannic acid is more to be depended upon as a topical than as a remote agent. It is converted into gallic and pyrogallic acids in the system.

Acidum Gallicum—Gallic Acid.—An acid ($3HO,C_{14}H_3O_7+2HO$, or $H_3C_7H_3O_5H_2O$) prepared from galls. Officinal preparation: *Glycerinum Acidi Gallici.*

PREPARATION.—*Take of galls, in coarse powder,* 1 *pound; distilled water, a sufficiency. Place the powder of galls in a porcelain dish, pour on as much of the water as will convert it into a thick paste, and keep it in this moistened condition for six weeks, at a temperature of between* 60° *and*

70°, *adding distilled water from time to time to supply what is lost by evaporation. At the end of that time, boil the paste for twenty minutes with forty-five fluid ounces of the water, strain through calico, and when the fluid has cooled, collect on a filter the crystalline deposit which has formed, and let it drain. Press it strongly between folds of filtering paper, and redissolve in ten ounces of boiling distilled water. When the fluid has cooled to* 80°, *pour it off from the crystals which have formed, wash these with three ounces of ice-cold distilled water, and dry them, first by filtering paper, and finally at a temperature not exceeding* 100°. *By boiling the undissolved portion of the galls with forty-five additional ounces of water, filtering into a dish containing the liquor decanted from the crystals, in the preceding process, evaporating to the bulk of ten ounces, and cooling to* 80°, *an additional quantity of acid may be obtained, which, however, is usually a little darker in colour than the product of the previous crystallisation.*

Rationale.—Galls contain a comparatively small quantity of gallic acid, but a large quantity of tannic acid ; but when the tannic acid is moistened and exposed to the atmosphere, it absorbs oxygen, and is converted into gallic acid, carbonic acid, and water ; thus $C_{27}H_{22}O_{17} + 12O = 3H_3C_7H_3O_5 + 2H_2O + 6CO_2$. After exposure for six weeks, by which time most of the tannin is oxidised, the paste is boiled and strained, whereby the undecomposed tannin and the gallic acid are separated from the rest of the ingredients of the galls, and as the liquor cools, these two also are separated, the gallic acid, which is less soluble than the tannin, being crystallised out, whilst the undecomposed tannic acid remains dissolved in the mother liquor.

CHARACTERS.—*Crystalline, in acicular prisms or silky needles, sometimes nearly white, but generally of a pale fawn colour. It requires about a hundred parts of cold water for its solution, but dissolves in three parts of boiling water. Soluble also in rectified spirit.*

TESTS.—*The aqueous solution gives no precipitate with solution of isinglass. It gives a bluish-black precipitate with a persalt of iron. The crystalline acid when dried at* 212° *loses* 9·5 *per cent. of its weight. It leaves no residue when burned with free access of air.*

Gallic acid is inodorous, but has an acidulous styptic taste. It may be obtained in satiny acicular crystals, but is usually met with as a yellowish crystalline powder. It does not give a precipitate with gelatine, and by this test it may be distinguished from tannic acid.

GLYCERINUM ACIDI GALLICI—GLYCERINE OF GALLIC ACID. —*Take of gallic acid,* 1 *ounce; glycerine,* 4 *fluid ounces. Rub them together in a mortar, then transfer the mixture to a porcelain dish, and apply a gentle heat until complete solution is effected.*

A convenient mode of administering gallic acid. Internally, it may be given in doses of half-a-drachm to a drachm, as an astringent in menorrhagia, hæmoptysis, &c.

Dose.—Three to ten, fifteen, or more grains, three or four times a-day, of the glycerine, one-half to one fluid drachm, it may be given also in the form of pill or mixture, but when given with an aqueous vehicle, it requires mucilage to suspend it.

Gallic acid acts as a powerful astringent, and may be employed in the cases mentioned as being amenable to the internal use of tannic acid, for which purposes, indeed, it is much better adapted. Gallic acid is as much superior to tannic acid as an internal and remote astringent, as tannic acid is to gallic acid as an external and topical astringent. It is found not to constipate the bowels, which is also frequently a matter of considerable therapeutical importance.

2. *Gymnospermæ or Gymnogenæ.*

CONIFERÆ or PINACEÆ—The Coniferous or Pine Order.—Resinous trees or shrubs, inhabiting various parts of the world, both in cold and warm climates, but chiefly met with in the temperate regions of both hemispheres—in the former chiefly as pines, spruces, larches, cedars, and junipers ; in the latter as species of Araucaria, Eutassa, and Dammara. Officinal plants: *Pinus palustris, Pinus Tæda, Pinus Pinaster, Pinus sylvestris, Abies excelsa, Abies balsamea, Juniperus communis, Juniperus sabina.*

Botany—Pinus—Pine.—*Monœcia Monadelphia*—Generic character. *Flowers,* monœcious; males, catkins racemose; females, catkins solitary, or from two to three. *Ovaries,* two. Scales of the cone hard, woody, and truncated, hollowed at the base for the reception of the seeds. *Seeds,* in pairs, covered with a sharp pointed membrane. *Leaves,* two or many in the same sheath, evergreen. *Pinus Palustris*—The Swamp Pine—a large tree, growing between the southern parts of Virginia and the gulf of Mexico. *Pinus Tæda*—The Frankincense Pine—a large tree abounding in Virginia. *Pinus Pinaster*—The Cluster Pine—inhabiting the southern shores of Europe, abounding in the *Landes. Pinus sylvestris*—Scotch Fir—a tall, straight tree, inhabiting Scotland, Norway, woods of Europe north of the Alps. Abies—*Monœcia Monadelphia*—Generic character. *Flowers,* monœcious ; males, catkins solitary, not racemose ; females, catkins solitary. Scales of the cone imbricated, thin at the apex, rounded, flat, not hollowed for the seeds as in the *Pinus. Leaves,* solitary in each sheath. *Abies excelsa*—Norway Spruce Fir—a lofty tree, inhabiting the northern parts of eastern Europe, and the northern parts of Asia ; cultivated in England. *Abies balsamea*—Balm of Gilead and Canadian Balsam Fir. *Habitat,* northern parts of North America.

Oleum Terebinthinæ—Oil of Turpentine.—Officinal plants: *Pinus Palustris,* Miller's Dict. ; *Pinus Tæda,* Linn. ; and sometimes *Pinus Pinaster,* Aiton. Illustration, plates 9, 10, 16, 17, 20, *Lambert, Pinus.* Officinal part: The oil, distilled from the oleo-resin (turpentine), imported from America and France. Officinal preparations : *Confectio Terebinthinæ, Enema Terebinthinæ, Linimentum Terebinthinæ, Linimentum Terebinthinæ Aceticum, Unguentum Terebinthinæ.*

Characters.—*Limpid, colourless, with a strong, peculiar odour, and pungent and bitter taste.*

Turpentine is obtained by tapping the pines at the lower part of the

stem near the roots. It is an oleo-resin, at first liquid, but when kept for some time, it hardens, partly by the escape of the volatile oil, and partly by its resinification. The resin is dissolved in the volatile oil. By distillation, the oil is removed, leaving the resin behind. *Volatile oil of turpentine*—commonly called *Spirits of Turpentine*—has the constitution $C_{10}H_{16}$, a specific gravity of 0·86, is scarcely soluble in water, but is soluble in ether and in alcohol. When exposed to the air, it partly volatilises, and partly resinifies, absorbing oxygen. It is highly inflammable, burning with a yellow smoky flame. With hydrochloric acid it forms hydrochlorate of turpentine or *artificial camphor*.

CONFECTIO TEREBINTHINÆ—Confection of Turpentine.—*Take of oil of turpentine, 1 fluid ounce; liquorice root, in powder, 1 ounce; clarified honey, 2 ounces. Rub the oil of turpentine with the liquorice, add the honey, and mix to a uniform consistence.*

ENEMA TEREBINTHINÆ—Enema of Turpentine.—*Take of oil of turpentine, 1 fluid ounce; mucilage of starch, 15 fluid ounces. Mix.*

LINIMENTUM TEREBINTHINÆ—Linimentum of Turpentine.—*Take of soft soap, 2 ounces; camphor, 1 ounce; oil of turpentine, 16 fluid ounces. Dissolve the camphor in the oil of turpentine, then add the soap, rubbing them together until they are thoroughly mixed.*

LINIMENTUM TEREBINTHINÆ ACETICUM—Liniment of Turpentine and Acetic Acid.—*Take of oil of turpentine; acetic acid; liniment of camphor, of each, 1 fluid ounce. Mix.*

UNGUENTUM TEREBINTHINÆ—Ointment of Turpentine.—*Take of oil of turpentine, 1 fluid ounce; resin, in coarse powder, 60 grains; yellow wax; prepared lard; of each, ½ an ounce. Melt the ingredients together by the heat of a steam or water-bath. Remove the vessel, and stir the mixture constantly while it cools.*

Resina—Resin.—The residue of the distillation of the turpentines from various species of *Pinus*, Linn., and *Abies*, Lam. Officinal preparations: *Emplastrum Resinæ, Unguentum Resinæ.* Enters into the formation of *Charta Epispastica,* and of most of the officinal Emplastra.

Characters.—*Translucent, yellowish, brittle, pulverisable; fracture shining; odour and taste faintly terebinthinate. It is easily fusible, and burns with a dense yellow flame and much smoke.*

The resin of commerce varies much in its physical characters. It contains three acids: *Pinic acid, Sylvic acid,* and *Colophonic acid,* the latter of which is formed by the action of heat upon the sylvic acid.

EMPLASTRUM RESINÆ—Resin Plaster.—*Take of resin, 4 ounces; lead plaster, 2 pounds; hard soap, 2 ounces. To the lead plaster, previously melted with a gentle heat, add the resin and soap, first liquefied, and stir them until they are thoroughly mixed.*

UNGUENTUM RESINÆ—Ointment of Resin.—*Take of resin, in coarse powder, 8 ounces; yellow wax, 4 ounces; simple ointment, 16 ounces. Melt with a gentle heat, strain the mixture while hot through flannel, and stir constantly while it cools.*

Dose.—Of oil of turpentine, as a diuretic, ten to thirty minims; as a general stimulant or antispasmodic, ten minims to a fluid drachm; as an anthelmintic or revulsive purgative, half-a-fluid ounce to two fluid ounces (for children, one fluid drachm to half-a-fluid ounce). It may be given floating on an aromatic water, made into an emulsion with mucilage or yolk of egg, or in the form of confection. Of the confection, half-an-ounce to an ounce for a child, one to four ounces for an adult, as an anthelmintic. The quantity of the enema prescribed in the Pharmacopœia is the dose for an adult; one half or one quarter may be given to a child, according to age.

Turpentine acts in small doses as a stimulant, diuretic, diaphoretic, astringent, and antispasmodic; in larger doses as an anthelmintic and derivative purgative. Externally, it acts as a rubefacient and counter-irritant. It communicates a violet odour to the urine, It occasionally produces nausea, vertigo, feverish restlessness, a kind of intoxication, delirium, coma, strangury, or a cutaneous eruption, one or more of which symptoms are produced in some persons by turpentine in any form; untoward results may follow the use of turpentine even when given in medium doses. Turpentine has been employed internally in a variety of cases, the chief objects of its administration being to arouse the vital energies, to arrest passive hemorrhages and chronic mucous discharges, to act as a diaphoretic, diuretic, or anthelmintic, &c. Externally, it is employed as a rubefacient and counter-irritant; it may be applied in the form of one of the liniments, or by dipping flannel into hot water, wringing it, sprinkling the surface with oil of turpentine, and then applying it as hot as the patient can bear it. Resin, or *Basilicon*, ointment is used as a stimulating and detergent application to indolent and offensive ulcers. Resin plaster is the common adhesive or *sticking* plaster.

Terebinthina Canadensis—Canada Balsam.—Officinal plant: *Abies balsamea*, Aiton., *Hort. Kew;* Balm of Gilead Fir. Illustration, plate 31, Lambert *Pinus* (*Pinus balsamea*). Officinal part: The turpentine, obtained from the stem by incision, in Canada.

Characters.—*A pale-yellow ductile oleo-resin, of the consistence of thin honey, with a peculiar agreeable odour, and a slightly bitter, feebly acrid taste; by exposure drying very slowly into a transparent adhesive varnish; solidifying when mixed with a sixth of its weight of magnesia.*

It enters into the preparation of *Collodium Flexile,* and of *Charta Epispastica.*

Canada Balsam, so called, is a pure oleo-resin; it may be used in many cases as a substitute for the common oil of turpentine, but is chiefly employed in chronic mucous discharges from the genito-urinary organs. It may be given in doses of twenty or thirty grains, either in the form of pills or emulsion.

Thus Americana — Common Frankincense. — Officinal plant: *Pinus Tæda*, Linn., the Frankincense Pine; and *Pinus palustris*, Miller's Dict., the Swamp Pine. Illustrations, plates 16, 17, and 20, Lambert, *Pinus*. Officinal part: The concrete turpentine; from the Southern States of North America. Enters into *Emplastrum Picis*.

CHARACTERS.—*A softish bright-yellow opaque solid, resinous but tough, having the odour of American turpentine.*

Frankincense possesses the properties of the other turpentines, but is used only as an adjunct to plasters, to give consistence, as in the pitch plaster.

Pix Burgundica—Burgundy Pitch.—Officinal Plant: *Abies excelsa* Lamarck; the Spruce Fir. Illustration, plate 208, *Woodv. Med. Bot.* (*Pinus Abies*). Officinal part: A resinous exudation from the stem, melted and strained; imported from Switzerland. Officinal preparation: *Emplastrum Picis;* enters also into the preparation of Emplastrum Ferri.

CHARACTERS.—*Hard and brittle, yet gradually taking the form of the vessel in which it is kept; opaque, varying in colour, but generally dull reddish-brown; of a peculiar somewhat empyreumatic perfumed odour, and aromatic taste.*

PURITY TESTS.—*Without bitterness; free from vesicles; gives off no water when it is heated.*

EMPLASTRUM PICIS—PITCH PLASTER.—*Take of Burgundy pitch,* 26 *ounces; common frankincense,* 13 *ounces; resin and yellow wax, of each,* 4½ *ounces; expressed oil of nutmeg,* 1 *ounce; olive oil and water, of each,* 2 *fluid ounces. Add the oils and the water to the frankincense, Burgundy pitch, resin, and wax, previously melted together; then, constantly stirring, evaporate to a proper consistence.*

Pitch is used only externally, as a stimulant and somewhat irritant application to the chest in chronic pulmonary complaints; to the loins in lumbago, to local neuralgic pains, &c., in the form of pitch plaster. It occasionally causes a pustular eruption.

Pix Liquida—Tar.—Officinal plants: *Pinus sylvestris*, Linn., and other Pines. Officinal part: A bituminous liquid, obtained by destructive distillation.

CHARACTERS.—*Thick, viscid, brownish-black, of a well-known peculiar aromatic odour. Water agitated with it acquires a pale brown colour, sharp empyreumatic taste, and acid reaction.*

Tar is rarely employed internally, although it was formerly used in the treatment of phthisis. Externally, it is used as a topical stimulant application to chronic skin diseases.

UNGUENTUM PICIS LIQUIDÆ—OINTMENT OF TAR.—*Take of tar,* 5 *ounces; yellow wax,* 2 *ounces. Melt the wax with a gentle heat, add the tar, and stir the mixture briskly while it cools.*

This is tar ointment according to the formula in the Edinburgh Pharmacopœia. It is a specific for psoriasis, the cure being effected

in a period varying from a month to six weeks. The objection to its use is its filthiness and disagreeable smell, and that the patient, when under treatment, requires to keep his room. It is also recommended in other skin diseases, as in ringworm of the scalp. Mixed with an equal bulk of citrine ointment, it is found very beneficial in prurigo senilis.

Oleum Juniperi—Oil of Juniper.—Officinal plant: *Juniperus communis*, Linn.; *Diœcia Monadelphia*, Common Juniper. Illustration, plate 95, *Woodv. Med. Bot.* Officinal part: The oil, distilled in Britain from the unripe fruit. Officinal preparation: *Spiritûs Juniperi.*

Botany.—A bushy shrub. *Leaves*, evergreen, numerous, three in each whorl, linear-subulate, keeled. *Flowers*, diœcious, axillary, sessile. *Fruit*, a purplish-black berry, which ripens in the autumn of the second year. *Habitat*, northern parts of Europe, Asia, and America.

CHARACTERS OF THE OIL.—*Colourless or pale greenish-yellow, of a sweetish odour, and warm aromatic taste.*

The oil is obtained from the fruit by distillation with water; it is isomeric with oil of turpentine, $C_{10}H_{16}$; specific gravity, 0·8.

SPIRITUS JUNIPERI.—*Take of oil of juniper*, 1 *fluid ounce; rectified spirit*, 49 *fluid ounces. Dissolve.*

One-fifth the strength of the preparation of the same name in the British Pharmacopœia of 1864.

Dose.—Of the oil, two to six minims, either in pill, on sugar, or as the spirit; of the spirit, one-half to one fluid drachm. The berries may be used as an infusion. Oil of Juniper may be inhaled with the vapour of hot water.

Juniper acts as a stimulating diuretic, and the spirit is usually employed as an adjunct to mixtures of that class. Hollands gin owes its flavour and diuretic qualities to oil of juniper. It enters into the preparation of *Mistura Creasoti.*

Oleum Cadinum—Oil of Cade—*Huile de Cade—Oleum Empyreumaticum Juniperi.*—A tarry oil, obtained by the dry distillation of the wood of *Juniperus Oxycedrus.* Oil of cade is rarely given internally, but it has been employed as an anthelmintic. Its chief medicinal use is as a stimulant and detergent topical application to chronic skin diseases. It may be applied as an ointment, or dissolved in spirit as a lotion, or as a soap—*oil of cade soap.* An *oil of pitch*, somewhat resembling oil of cade, may be obtained by distilling tar.

Sabina—Savin. Officinal plant; *Juniperus Sabina*, Linn.; *Diœcia Monadelphia;* Common Savin. Illustration, plate 94, *Woodv. Med. Bot.* Officinal parts:—1. *Sabinæ Cacumina*—Savin tops: the fresh and dried tops; collected in spring, from plants cultivated in Britain. 2. *Oleum Sabinæ*—Oil of Savin: the oil, distilled in Britain from fresh Savin. Officinal preparations: *Tinctura Sabinæ, Unguentum Sabinæ.*

Botany.—A small bushy shrub. *Leaves,* small, ovate, densely imbricated, opposite, glandular. *Fruit,* round, bluish-purple, about the size of a currant. *Habitat,* middle and south of Europe, Russia in Asia.

CHARACTERS OF THE TOPS.—*Twigs densely covered with minute imbri cated appressed leaves in four rows; odour, strong, peculiar, and unplea sant; taste, acrid, bitter, resinous, and disagreeable.*

CHARACTERS OF THE OIL.—*Colourless or pale-yellow.*

The medicinal properties of the plant are due to its volatile oil, which is obtained from the fresh tops by distillation with water. The oil has the unpleasant odour of the plant, and a bitter acrid taste; it is limpid, and is isomeric with oil of turpentine, $C_{10}H_{16}$.

TINCTURA SABINÆ—TINCTURE OF SAVIN.—*Take oj savin tops, dried and coarsely powdered,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the savin for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

UNGUENTUM SABINÆ—OINTMENT OF SAVIN—*Synonym:* Ceratum Sabinæ, Edin.—*Take of fresh savin tops, bruised,* 8 *ounces; yellow wax,* 3 *ounces; prepared lard,* 16 *ounces. Melt the lard and the wax together on a water-bath, add the savin, and digest for twenty minutes. Then remove the mixture, and express through calico.*

Dose.—Of the powder (ineligible), five to fifteen grains; of the tincture, twenty minims to one fluid drachm; of the oil, two to six minims, with mucilage.

Savin in over-doses acts as a powerful local irritant, causing vomiting, purging, and severe pain in the stomach and intestines, with inflammation of the parts. Externally the oil acts as a rubefacient and vesicant. In poisoning by savin the indications are to allay pain by opiates, inflammatory action by antiphlogistics, and to soothe the parts by demulcents. Savin is occasionally used with the criminal intention of procuring abortion, a practice which is scarcely less dangerous than immoral, and may occasion the death of the mother by producing severe inflammation. Medicinally, it is not much given internally, but may be employed as an emmenagogue in amenorrhœa and chlorosis; but as it acts by stimulating the uterus, it is contra-indicated in irritable and inflammatory states of that organ or of the adjoining viscera. The ointment acts as a topical irritant, and is chiefly used as an application to setons and blisters, for the purpose of maintaining a perpetual sore. Equal parts of savin and verdigris in powder, or of savin and alum in powder, are used as applications to venereal warts.

CLASS II.—MONOCOTYLEDONES, ENDOGENÆ, OR AMPHIBRYA.

SUB-CLASS I.—DICTYOGENÆ.

SMILACEÆ—The Sarsaparilla Order.—Herbs or shrubby plants, often climbing, natives of temperate and tropical regions. The plants possess demulcent, diuretic, and alterative properties. Officinal plant: *Smilax officinalis.*

Sarsæ Radix—Jamaica Sarsaparilla.—Officinal plant: *Smilax officinalis.* Humb. and Bonpl.; *Diœcia Hexandria.* Officinal part: The dried root; native of Central America; imported from Jamaica. Officinal preparations: *Decoctum Sarsæ, Decoctum Sarsæ Compositum, Extractum Sarsæ Liquidum.*

Botany.—A shrubby diœcious creeper. *Stem,* twin, quadrangular, prickly, smooth, young shoots roundish and unarmed. *Leaves,* a foot long, four or five inches broad, ovate, oblong, acute; leaf-stalk, an inch long, smooth, with two tendrils at the base. *Habitat,* New Granada, Honduras.

CHARACTERS.—*Roots not thicker than a goose-quill, generally many feet in length, reddish-brown, covered with rootlets, and folded in bundles about eighteen inches long, scentless; taste mucilaginous, feebly bitter, faintly acrid.*

Commercial Sarsaparilla consists of the fibrous root of the plant, often bearing also a portion of the root-stock, or subterranean tuberous stem, called by druggists the "chump." From the rhizome, which lies either horizontally or obliquely in the ground, stems are sent upwards and true root-fibres downwards. The rhizome is a solid mass, presenting no distinct division into bark, wood, and pith. The true root-fibres are many feet in length, and usually about the thickness of a quill. They receive a variety of names, according to their condition: when old, dry, and withered, they are called *lean;* when plump and fully swelled out, they are called *gouty;* when they are well filled with starch, they are called *mealy;* when the fibres give off numerous little fibrillæ they are said to be *bearded.* The root is almost inodorous, but has a mucilaginous and somewhat acrid taste. It is of a reddish-brown colour externally, and is divisible into an outer bark or cortex, and an inner meditullium surrounding the pith. The roots are commonly imported in bundles, twisted or rolled into different shapes; sometimes they have portions of the rhizome or chump adherent, and this occasionally bears the remnants of the aerial stems. The sarsaparilla of commerce is distinguished by the names of countries by which it is furnished; thus it is known as Mexican, Guatemala, Honduras, Costa Rica, Lima, Columbian, Brazilian, Peruvian, Caraccas, Vera Cruz, Jamaica. These different kinds are recognised chiefly by slight differences in their external appearances, especially by the manner in which the bundles are constructed. The Jamaica variety is one of the most esteemed, and bears the officinal characters. Sarsaparilla is subject to adulteration with the roots of other plants, and, moreover, inferior kinds are apt to be substituted for the better. The means usually employed to detect sophistications are the taste and exter-

nal appearance of the drug. Sarsaparilla contains, besides other ingredients, a peculiar crystallisable neutral principle, which has received at different times the names of *paraglin, salseparin, parallinic acid,* and *smilacin.* It is more commonly known by the latter name. It is white, crystallisable, has a bitter taste, is partially soluble in cold, and more so in boiling water, and also in hot spirit, in ether, and in oils. Sarsaparilla also contains a volatile oil, which has the acrid taste of the root, but is almost entirely lost in the drying; it also contains an acrid bitter resin, mucilage, lignin, &c. It yields its active ingredients to hot and cold water, and to dilute spirit. Its activity is impaired by long boiling.

DECOCTUM SARSÆ — DECOCTION OF SARSAPARILLA.—*Take of Jamaica sarsaparilla, cut transversely,* 2½ *ounces; boiling distilled water,* 1½ *pint. Digest the sarsaparilla in the water for an hour, then boil for ten minutes in a covered vessel, cool, and strain, pouring distilled water, if required, over the contents of the strainer, or otherwise making the strained product measure a pint.*

DECOCTUM SARSÆ COMPOSITUM—COMPOUND DECOCTION OF SARSAPARILLA.—*Take of Jamaica sarsaparilla, cut transversely,* 2½ *ounces; sassafras root, in chips; guaiacum wood turnings; and fresh liquorice root, bruised, of each,* ¼ *ounce; mezereon bark,* 60 *grains; boiling distilled water,* 1½ *pint. Digest the solid ingredients in the water for an hour, then boil for ten minutes in a covered vessel; cool and strain, pouring distilled water, if required, over the contents of the strainer, or otherwise making the strained product measure a pint.*

EXTRACTUM SARSÆ LIQUIDUM—LIQUID EXTRACT OF SARSAPARILLA.— *Take of Jamaica sarsaparilla, cut transversely,* 1 *pound; distilled water, at* 160°, 14 *pints; rectified spirit,* 1 *fluid ounce. Digest the sarsaparilla in one-half of the water for six hours, and decant the liquor. Digest the residue in the remainder of the water for the same time, express and filter the mixed liquors, and evaporate them by a water-bath to seven fluid ounces, or until the specific gravity of the liquid is* 1·13. *When cold, add the spirit. The specific gravity should be about* 1·095.

Dose.—Of the simple decoction, four to eight fluid ounces; of the compound decoction, three to six fluid ounces—it is the old *decoction of sweet woods,* and an imitation of the celebrated *Lisbon diet drink;* of the fluid extract, thirty minims to three or four fluid drachms.

There has been, as yet, but little explanation given of the physiological action of sarsaparilla; it is said to act as an alterative, diaphoretic, and tonic. In over-doses the powdered root and smilacin have produced nausea, vomiting, and derangement of the digestive organs. The kinds which contain a good deal of starch act as demulcents. Perhaps there is no drug about whose medicinal value so great a diversity of opinion exists as sarsaparilla. There are those in the profession who esteem it highly, and there are others who value it no more than straw; nevertheless, it is extensively employed, and it has been said that, as a rule, surgeons esteem it more than physicians. It is chiefly employed in the

treatment of inveterate venereal diseases, especially in those cases in which the patient's constitution is broken down, and the characteristic cachexia is well marked, and in which a too liberal use of mercury has added to the unhappy state of the patient. Its influence seems to be exercised rather upon the general cachectic condition of the patient, restoring his appetite and increasing his weight, rather than as a specific upon the disease itself. It does not prevent secondary symptoms when given early, nor does it appear to exercise any beneficial effects in primary cases; in short, it is said to be an alterative, but not specifically so. In combination with other suitable remedies, sarsaparilla is given in chronic rheumatism, in obstinate chronic cutaneous affections, and in the generally disordered states of the system distinguished by the generic name cachexia.

Sub-Class 2.—Petaloideæ or Floridæ.

ZINGIBERACEÆ or SCITAMINEÆ—The Ginger Order.—Herbs, nearly all tropical, abounding in the East Indies. The plants possess aromatic and stimulant properties. Officinal plants: *Zingiber officinale, Elettaria cardamomum.*

Zingiber — Ginger.—Officinal plant: *Zingiber officinale,* Roscoe; *Monandria Monogynia;* the Narrow-Leaved Ginger. Illustration, plate 11, *Woodv. Med. Bot. (Amomum Zingiber.)* Officinal part: The rhizome, scraped and dried; from plants cultivated in the West Indies, India, and other countries. Officinal preparations: *Syrupus Zingiberis, Tinctura Zingiberis, Tinctura Zingiberis Fortior;* enters into compound rhubarb powder, compound scammony powder, wine of aloes, &c.

Botany.—Rootstock, perennial, creeping. *Stem,* annual, two to four feet high, erect, invested by the long smooth sheaths of distichous leaves. *Leaves,* linear-lanceolate, smooth. *Inflorescence,* radical, elevated, solitary spikes; flowers, purple.

Characters.—*Irregular, lobed, decorticated pieces, three or four inches long, subcompressed, yellowish-white, but not chalky on the surface, with a short mealy fracture, hot taste, and agreeable aroma. Powder yellowish white.*

The rootstock is dug up at the commencement of its second year, and is either scraped and dried to form white ginger, or simply scalded and dried in the sun, to constitute dark ginger. The tender shoots of the young rhizome, when scalded, scraped, and kept in syrup, constitute *preserved ginger.* Powdered ginger is apt to be adulterated with flour and other substances. The more important ingredients of ginger are volatile oil, resin, and starch. The volatile oil, upon which its properties chiefly depend, is pale yellow and light, and has the odour and the acrid burning taste of ginger.

SYRUPUS ZINGIBERIS — Syrup of Ginger.— *Take of strong*

tincture of ginger, 6 *fluid drachms; syrup*, 19 *fluid ounces. Mix, with agitation.*

TINCTURA ZINGIBERIS—Tincture of Ginger.—*Take of ginger, in coarse powder*, $2\frac{1}{2}$ *ounces; rectified spirit*, 1 *pint. Macerate the ginger for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.*

TINCTURA ZINGIBERIS FORTIOR—Strong Tincture of Ginger—Essence of Ginger.—*Take of ginger, in fine powder*, 10 *ounces; rectified spirit, a sufficiency. Pack the ginger tightly in a percolator, and pour over it carefully half-a-pint of the spirit. At the expiration of two hours add more spirit, and let it percolate slowly until one pint of tincture has been collected.*

Dose.—Of powdered ginger, five to twenty, or thirty grains; of the syrup, one to two fluid drachms; of the tincture, thirty minims to one fluid drachm; of the strong tincture, five to twenty minims.

Ginger acts as an aromatic stimulant, carminative, and stomachic, and is chiefly used as a corrective adjunct to obviate the nausea and griping of certain purgatives, and as a stimulant in atonic dyspepsia with flatulence. It is also occasionally used as a masticatory. Externally, it acts as an irritant and rubefacient.

Cardamomum—Cardamoms.—Officinal plant: *Elettaria cardamomum*, Maton.; *Monandria Monogynia;* the Malabar Cardamom. Illustration, *Trans. Linn. Soc.* vol. x. plates 4 and 5. Officinal parts: The seeds contained in their capsules, which are to be removed when the seeds are employed; cultivated in Malabar. Officinal preparation: *Tinctura Cardamomi Composita;* enters into compound powder of cinnamon, aromatic powder of chalk, aromatic powder of chalk and opium, compound extract of colocynth, compound tincture of gentian, tincture of rhubarb, and wine of aloes, &c.

Botany.—Perennial, with numerous, fleshy, creeping rhizomes. *Stems*, perennial, erect, six to nine feet high. *Leaves*, one to two feet long, lanceolate, acuminate, pubescent above, silky beneath. *Inflorescence*, flexuose, procumbent scapes, arising from the base of the stem; flowers, alternate, short-stalked, on sub-erect racemes, greenish-white, marked, chiefly in the centre, with violet stripes. *Capsule*, oval, three-celled, three valved. *Seeds*, many, rough, tunicated.

Characters.—*Seeds obtusely angular, corrugated, reddish-brown, internally white, with a warm aromatic agreeable taste and odour, contained in ovate-oblong triangular pale-brown coriaceous ribbed pericarps.*

Malabar cardamoms are the dried fruit of the plant, and are gathered in November. Several varieties are recognised in commerce, and are distinguished by the designations *shorts, short-longs*, and *long-longs*. The

seeds are contained in the capsules; they have a warm, pungent taste, and a peculiar aromatic odour, depending upon a volatile oil.

TINCTURA CARDAMOMI COMPOSITA—COMPOUND TINCTURE OF CARDAMOMS.—*Take of cardamom seeds, freed from the pericarps and bruised, ¼ ounce; caraway fruit, bruised, ¼ ounce; raisins, freed from their seeds, 2 ounces; cinnamon bark, bruised, ½ ounce; cochineal, in powder, 60 grains; proof spirit, 1 pint. Macerate the solid ingredients for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of the compound tincture, thirty minims to two fluid drachms.

Cardamoms act as an aromatic stimulant, and are used as a stomachic or corrective adjunct to other medicines.

Turmeric—The rhizome of *Curcuma longa*, Linn.—Turmeric is placed in the appendix of the Pharmacopœia as a test. The plant is cultivated in India, China, and Java. Commercial turmeric is met with in various forms, but chiefly in what are termed *round* and *long* pieces; the long pieces are more common, they are about the size of the little finger. Turmeric affords a bright yellow powder, has a warm, bitterish taste, and a peculiar odour. Its warm, stimulating properties depend upon an acrid, odorous, volatile oil. Turmeric is a usual ingredient of curry powder, and is otherwise used as a condiment, but it is officinal only as a test for alkalies, which change its yellow colour to reddish-brown.

TURMERIC PAPER.—*Unsized paper steeped in tincture of turmeric, and dried by exposure to the air.*

TURMERIC TINCTURE.—*Take of turmeric, bruised, 1 ounce; proof spirit, 6 fluid ounces. Macerate for seven days, and filter.*

Marantaceæ or Cannaceæ—The Arrow-root Order.—Herbaceous plants, closely allied to the Zingiberaceæ, natives of the tropical parts of America, Africa, and Asia. The plants possess amylaceous properties. *Maranta arundinacea* was formerly officinal; the fecula of its tubers constitutes the arrow-root of commerce. It is obtained by beating the tubers into a pulp, washing out the starchy matter with water, separating it from the fibrous tissue by straining, and collecting it by subsidence. It is then dried in the sun, and forms the white, tasteless, inodorous, granular substance known as arrow-root, which is a pure form of starch. There are many kinds of arrow-root, known either by the names of the countries whence they are imported, or by the names of the plants producing them. *Maranta*, or *West Indian Arrow-root*, is the most esteemed variety; and it is liable to adulteration with inferior kinds. Arrow-root is used as a mild, non-stimulating article of diet, suitable for invalids and children. Several species of Canna furnish starchy substances, one of which, produced in the West Indies, is known as *Tous-les-mois*.

IRIDACEÆ—The Iris Order. Herbs, inhabiting temperate and warm parts of the world. The plants possess acrid, purgative, and emetic properties. Officinal plant: *Crocus sativus.*

Crocus—Saffron—Officinal plant; *Crocus sativus,* Linn.; *Triandria Monogynia;* The Saffron Crocus. Illustration, plate 101, *Steph. and Church. Med. Bot.* Officinal part: The stigma and part of the style, dried; imported from Spain, France, and Naples. Officinal preparation: *Tinctura Croci;* enters into aromatic powder of chalk, compound decoction of aloes, aloes and myrrh pill, compound tincture of cinchona, tincture of rhubarb, and aromatic powder of chalk and opium, and of ammoniated tincture of opium.

Botany.—*Corm,* roundish, giving off numerous radicles from its under surface. *Leaves,* seven or eight inches long, linear, with a white central stripe. *Flowers,* purplish with red veins, make their appearance in autumn. *Stigma,* protruded, drooping, with three linear divisions. *Habitat,* Asia Minor, cultivated in France, Spain, and Italy.

CHARACTERS.—*Thread-like styles, each terminated by three long orange-brown stigmas, broadest at the summit. Has a powerful aromatic odour. Rubbed on the wet finger, it leaves an intense orange-yellow tint.*

PURITY TEST.—*When pressed between folds of white filtering paper, it leaves no oily stain.*

The flowers are gathered early in the morning before they are expanded, the stigmata with part of the styles are torn out, spread upon paper, and dried, the rest of the flower being rejected. Cake Saffron is formed by pressing the too ripe or injured stigmata. Saffron, or Hay Saffron, occurs in loose masses; sixty thousand flowers yield but one pound of it, hence it is costly and liable to adulteration, especially with safflower (*Carthamus tinctorius,* of which the cake saffron met with in this country is chiefly composed), and with marigold and other substances. Saffron is chiefly imported from France, Spain, and Italy, and some from Bombay. It has a warm, bitterish taste, and an aromatic odour; it imparts a deep yellow colour to water and to spirit, and to the saliva when chewed.

TINCTURA CROCI—TINCTURE OF SAFFRON.—*Take of saffron,* 1 *ounce; proof spirit,* 1 *pint. Macerate the saffron for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of the tincture, one or two fluid drachms.

Saffron is seldom prescribed in this country except as a colouring agent; it has been used as an emmenagogue and anodyne in painful menstruation.

The rhizome of *Iris florentina,* Florence Iris, is the fragrant and aromatic Oris-root, which has the odour of violets, and is added as a perfume to dessicating powders, &c.

LILIACEÆ—The Lily Order.—Herbs, shrubs, or trees, natives both of temperate and tropical regions. The plants possess purgative, emetic, stimulant, diaphoretic, astringent, and other properties. Officinal plants : *Aloe Vulgaris* and other species, *Urginea Scilla.*

Aloe Barbadensis—Barbadoes Aloes.—Officinal plant : *Aloe Vulgaris,* Lam. ; *Hexandria Monogynia;* the Yellow flowering Aloe. Illustration, plate 109, *Steph. and Church. Med. Bot.* Officinal part : The juice of the leaf inspissated ; imported from Barbadoes. Officinal preparations : *Enema Aloes, Extractum Aloes Barbadensis, Pilula Aloes Barbadensis;* enters into the aloes and iron pill, compound pill of gamboge, compound pill of colocynth, and colocynth and hyoscyamus pill.

Aloe Socotrina—Socotrine Aloes.—Officinal plants : One or more undetermined species of aloe, Linn. Officinal part : The juice of the leaf inspissated ; usually procured from Socotra, and shipped to Europe by way of Bombay. Officinal preparations : *Decoctum Aloes Compositum, Enema Aloes, Extractum Aloes Socotrinæ, Pilula Aloes Socotrinæ, Tinctura Aloes, Vinum Aloes;* enters into compound extract of colocynth, aloes and assafœtida pill, aloes and myrrh pill, compound rhubarb pill, and compound tincture of benzoin.

Botany.—The various kinds of aloes are derived from succulent plants, which have woody stems, large amplexicaul leaves, and a spiked inflorescence. *Aloe Vulgaris* has a somewhat shrubby stem, simple and cylindrical; sword-shaped, fleshy, glaucous-green, and somewhat mottled leaves, armed with reddish spines ; and a cylindrical-ovate spike of yellow flowers. *Habitat,* South of Europe, India, Barbadoes.

Characters of Barbadoes Aloes.—*In yellowish-brown or dark-brown opaque masses; breaks with a dull conchoidal fracture ; has a bitter nauseous taste, and a strong disagreeable odour; dissolves almost entirely in proof spirit, and during solution exhibits under the microscope numerous crystals. Usually imported in gourds.*

Characters of Socotrine Aloes.—*In reddish-brown masses, opaque, or translucent at the edges; breaks with an irregular or smooth and resinous fracture; has a bitter taste, and a strong but fragrant odour; dissolves entirely in proof spirit, and during solution exhibits under the microscope numerous minute crystals.*

Several varieties of aloes are distinguished in commerce, such as Barbadoes, Socotrine, Hepatic, Indian, Cape, &c., but only the two former are officinal. They consist of the inspissated juice of the leaves. The true aloe juice lies immediately within the epidermis, and not in the interior of the leaves, and it readily runs out when the leaves are cut near the base, and placed in an upright position with the cut surface downwards. The juice thus collected is evaporated either by exposure to the sun or by the aid of artificial heat. The exudation of the juice is facilitated by dipping the leaves in hot water ; but when pressure is employed, the juice becomes mixed with the mucilage of the leaves, and an inferior kind of aloes is obtained. By boiling the leaves from which the juice had previously been obtained in the usual way, and evaporating the decoction, another very inferior kind of aloes is prepared, which is really an extract, and not an inspissated juice. The better varieties

correspond to the officinal character. The more important constituents of aloes are, *Aloin*, *Aloe resin*, and *Aloetic acid*. *Aloin* constitutes from sixty to eighty per cent. of the better kind of aloes. It has been largely prepared by Messrs T. & H. Smith of this city. It occurs in acicular crystals, and has the constitution $C_{34}H_{36}O_{14}H_2O$; it is inodorous, and has at first a sweetish taste, which afterwards becomes intensely bitter; it is soluble in warm ether, but very slightly so in cold water or alcohol. Chemically, it appears to belong to the glycerides, the aqueous extract of aloes being convertible, by boiling with a dilute acid, into glycose and aloesetic acid. *Aloe resin* is believed to be modified aloin; it is of a brown colour, transparent, soluble in alcohol, in ether, in alkaline solutions, and also, unlike true resins, in boiling water.

DECOCTUM ALOES COMPOSITUM—Compound Decoction of Aloes.—*Take of extract of Socotrine aloes,* 120 *grains; myrrh; saffron, of each,* 90 *grains; carbonate of potash,* 60 *grains; extract of liquorice,* 1 *ounce; compound tincture of cardamoms,* 8 *fluid ounces; distilled water, a sufficiency. Reduce the extract of aloes and myrrh to coarse powder, and put them, together with the carbonate of potash and extract of liquorice, into a suitable covered vessel with a pint of distilled water; boil gently for five minutes, then add the saffron. Let the vessel with its contents cool, then add the tincture of cardamoms, and, covering the vessel closely, allow the ingredients to macerate for two hours; finally, strain through flannel, pouring as much distilled water over the contents of the strainer as will make the strained product measure thirty fluid ounces.*

This decoction contains four grains of extract of aloes in one fluid ounce, while that of the British Pharmacopœia of 1864 contained 5·6 grains, and that of the London Pharmacopœia 3·3.

ENEMA ALOES—Enema of Aloes.—*Take of aloes,* 40 *grains; carbonate of potash,* 15 *grains; mucilage of starch,* 10 *fluid ounces. Mix, and rub together.*

EXTRACTUM ALOES BARBADENSIS—Extract of Barbadoes Aloes.—*Take of Barbadoes aloes, in small fragments,* 1 *pound; boiling distilled water,* 1 *gallon. Add the aloes to the water, and stir well, until they are thoroughly mixed. Set aside for twelve hours; then pour off the clear liquor, strain the remainder, and evaporate the mixed liquors by a water-bath or a current of warm air to dryness.*

EXTRACTUM ALOES SOCOTRINÆ—Extract of Socotrine Aloes.—*Take of Socotrine aloes, in small fragments,* 1 *pound; boiling distilled water,* 1 *gallon. Add the aloes to the water, and stir well until they are thoroughly mixed. Set aside for twelve hours; then pour off the clear liquor, strain the remainder, and evaporate the mixed liquors by a water-bath or a current of warm air to dryness.*

PILULA ALOES BARBADENSIS—Pill of Barbadoes Aloes.—*Take of Barbadoes aloes, in powder,* 2 *ounces; hard soap, in powder,* 1 *ounce; oil of caraway,* 1 *fluid drachm; confection of roses,* 1 *ounce. Beat all together until thoroughly mixed.*

PILULA ALOES SOCOTRINÆ—Pill of Socotrine Aloes.—*Take of Socotrine aloes, in powder,* 2 *ounces; hard soap, in powder,* 1 *ounce;*

volatile oil of nutmeg, 1 *fluid drachm; confection of roses,* 1 *ounce. Beat all together until thoroughly mixed.*

PILULA ALOES ET ASSAFŒTIDÆ—PILL OF ALOES AND ASSAFŒTIDA.—*Take of Socotrine aloes, in powder; assafœtida, hard soap, in powder; confection of roses, of each,* 1 *ounce. Beat all together until thoroughly mixed.*

PILULA ALOES ET MHYRRÆ—PILL OF ALOES AND MYRRH.—*Take of Socotrine aloes,* 2 *ounces; myrrh,* 1 *ounce; saffron, dried,* ½ *ounce; confection of roses,* 2½ *ounces. Triturate the aloes, myrrh, and saffron together, and sift; then add the confection of roses, and beat them together into a uniform mass.*

TINCTURA ALOES—TINCTURE OF ALOES.—*Take of Socotrine aloes, in coarse powder,* ½ *ounce; extract of liquorice,* 1½ *ounce; proof spirit, a sufficiency. Macerate the aloes and extract of liquorice in fifteen fluid ounces of the spirit for seven days, in a closed vessel, with occasional agitation, then filter, and add sufficient proof spirit to make one pint.*

VINUM ALOES—WINE OF ALOES.—*Take of Socotrine aloes,* 1½ *ounce; cardamom seeds, freed from the pericarps and bruised; ginger, in coarse powder, of each,* 80 *grains; sherry,* 2 *pints. Macerate for seven days in a closed vessel, with occasional agitation; filter the liquor, and add sufficient sherry to make two pints.*

Dose.—Of Barbadoes or Socotrine aloes, two to six grains, in pill; of aloin, half-a-grain to two grains; of the compound decoction, half a fluid ounce to two fluid ounces; of the extracts, two to six or more grains; of the pills, five to ten grains; of the aloes and assafœtida pill, five to twenty grains; of the aloes and myrrh pill, five to fifteen grains; of the tincture, one to three or four fluid drachms; of the wine, one to two or three fluid drachms.

Aloes act in small doses as tonics and stomachics, and in larger doses as warm stimulant and tonic cathartics. As purgatives they are slow of action, and affect chiefly the large intestines. In some persons they produce severe irritation of the mucous membrane of the rectum, and tenesmus, in which cases they should be combined with hyoscyamus. Aloes may be given as purgatives in torpid states of the bowels, especially when the liver also is in a sluggish condition. Being slow in their action, they are not available when a prompt evacuation of the bowels is demanded. In habitual constipation, in cases in which the large intestines are apt to become loaded and inactive, in sluggish conditions of the uterine system, in amenorrhœa, &c., an aloetic purge may be given occasionally. Aloes should not be given in inflammatory states of the liver and intestines, nor in acute affections of the rectum or uterine organs, nor in certain hemorrhoidal cases, and they should be employed cautiously during pregnancy. The compound decoction acts as a

tonic, antacid, emmenagogue, and mild cathartic; it is a valuable medicine in amenorrhœa and anemia, and may be combined with chalybeates. The enema acts as a stimulating purgative, and is also employed to remove ascarides.

Scilla—Squill.—Officinal plant: *Urginea Scilla*, Steinheil; *Hexandria Monogynia*; Squill. Illustration, plate 118, *Woodv. Med. Bot.* Officinal part: The bulb, from the Mediterranean coasts; sliced and dried. Officinal preparations: *Acetum Scillæ, Oxymel Scillæ, Pilula Ipecacuanhæ cum Scillâ, Pilula Scillæ Composita, Syrupus Scillæ, Tinctura Scillæ.*

Botany.—Bulb, very large, roundish-ovate, half above ground. *Leaves,* all radical, twelve to eighteen inches long, broadly lanceolate, channelled, recurved, appear after the flowers. *Scape,* two to four feet high, terminated by a long dense raceme. *Flowers,* white or pale yellowish-green. *Capsule,* rounded, three-cornered, three-celled. *Seeds,* numerous, in two rows, flattened, winged, with a membranous testa. *Habitat,* shores of the Mediterranean.

CHARACTERS.—*Bulb pear-shaped, weighing from half-a-pound to ten pounds; outer scales membranous, brownish-red or white; inner scales thick, whitish, fleshy, juicy; taste mucilaginous, intensely and disagreeably bitter, somewhat acrid. The dried slices are white or yellowish-white, slightly translucent, scentless, disagreeably bitter, brittle and easily pulverisable if very dry, but, if exposed, readily recovering moisture and flexibility.*

The fresh bulb is pyriform, and varies in size from that of a clenched fist to the size of a child's head. It is composed of thick fleshy scales, which are thinner at the edges than elsewhere, and are closely applied to each other in an imbricated manner. The outer scales are usually thin and membranous, and are either whitish (*Squilla alba Mascula,* or *Hispanica*), or reddish (*Squilla rubra, femina,* or *Italica*). The inner and more fleshy scales, when cracked, are found to contain numerous spiral vessels, which, with care, may be drawn out, whilst the outer covering or cuticle of the scales, on microscopic examination, is found to contain acicular crystals (raphides), which enter largely into the composition of powdered squill. The bulbs are imported from the Mediterranean ports, and some also from St Petersburg and Copenhagen. They are sometimes imported entire, but more commonly in the dried state, cut into small, yellowish-white, diaphanous pieces, which are brittle when quite dry, but when exposed to the atmosphere readily absorb moisture and become flexible. The fresh bulb may be kept in dry sand. Before drying it, the outer scales should be removed, and the inner part be cut into thin transverse slices and exposed to a gentle heat, gradually raised to 100°. The bulbs are exceedingly tenacious of life, and will readily absorb moisture, and show symptoms of vitality long after attempts have been made to destroy them by drying. Squill contains, besides other constituents, a peculiar and exceedingly bitter principle, termed *scillitine,* and an acrid poisonous resin.

ACETUM SCILLÆ—VINEGAR OF SQUILL.—*Take of squill, bruised,* 2½ *ounces; diluted acetic acid,* 1 *pint; proof spirit,* 1½ *fluid ounce. Ma-*

cerate the squill in the acetic acid for seven days, then strain with expression; add the spirit to the strained liquor, and filter.

An excellent expectorant and diuretic. Employed in chronic pulmonary affections and dropsies, also in the preparation of the *Oxymel Scillæ* and the *Syrupus Scillæ.*

OXYMEL SCILLÆ—OXYMEL OF SQUILL.—*Take of vinegar of squill,* 1 *pint; clarified honey,* 2 *pounds. Mix and evaporate by a water-bath until the product, when cold, shall have a specific gravity of* 1·32.

This preparation is re-introduced from the London Pharmacopœia. It is employed as an expectorant in bronchitis, especially in chronic cases. It is sometimes given as an emetic to children suffering from whooping-cough.

PILULA SCILLÆ COMPOSITA—COMPOUND SQUILL PILL.—*Take of squill, in powder,* 1¼ *ounce; ginger, in powder; ammoniacum, in powder; hard soap, in powder, of each,* 1 *ounce; treacle, by weight,* 2 *ounces, or a sufficiency. Mix the powders, add the treacle, and beat into a uniform mass.*

SYRUPUS SCILLÆ—SYRUP OF SQUILL.—*Take of vinegar of squill,* 1 *pint; refined sugar,* 2½ *pounds. Dissolve with the aid of heat.*

TINCTURA SCILLÆ—TINCTURE OF SQUILL.—*Take of squill, bruised,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the squill for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of powdered squill, as an expectorant or diuretic, one to two or three grains; in doses of from six to ten or fifteen grains powdered squill acts, though uncertainly, as an emetic. Of the compound pill, five to ten or fifteen grains. Of acetum *Scillæ,* fifteen to forty minims. Of the syrup, or of the oxymel, thirty minims to one, two, or more drachms; as an emetic for children, a teaspoonful may be given every quarter of an hour. Of the tincture, ten to thirty minims.

Squill acts in over-doses as a narcotico-acrid poison, producing vomiting, purging, severe griping, strangury, and inflammation of the stomach and bowels; twenty-four grains of the powder have caused death. In full-doses, squill acts as an emetic, but is uncertain in its operation. In small medicinal doses it acts as a diuretic and expectorant, stimulating the kidneys and the broncho-pulmonary mucous membrane; it acts more or less also upon the gastro-intestinal mucous membrane, occasionally operating as a laxative. As a diuretic it is useful in dropsies, more especially if resulting from cardiac disease, and for that purpose it is usually given until it produces nausea; as an expectorant it is useful in chronic bronchial pulmonary complaints. In consequence of its irritant qualities, it

is contra-indicated in acute inflammatory diseases. As an emetic it is very uncertain in its action, and is rarely given as such, except perhaps occasionally, in the form of the syrup, to children with whooping-cough. As a diuretic in heart disease, its activity is greatly promoted by combination with digitalis, or with digitalis and blue pill.

MELANTHACEÆ or COLCHICACEÆ—The Colchicum Order.—Herbs, generally distributed over the world, but most abundant in northern countries. Officinal plants: *Colchicum autumnale, Asagræa officinalis, Veratrum Viride.*

Colchicum—Colchicum. Officinal plant: *Colchicum autumale,* Linn.; *Hexandria Trigynia;* Meadow Saffron. Illustration, plate, 177, *Woodv. Med. Bot.* Officinal parts:—1. *Colchici Cormus;* the fresh corm, indigenous; collected about the end of June; and the same stripped of its coats, sliced transversely, and dried at a temperature not exceeding 150°. Officinal preparations: *Extractum Colchici, Extractum Colchici Aceticum, Vinum Colchici.* 2. *Colchici semen;* Colchicum Seed. The seed, fully ripe. Officinal preparation: *Tinctura Colchici Seminis.*

Botany.—*Root,* fibrous. *Corm,* ovate, fleshy, covered with a loose brown tegument. *Leaves,* flat, broadly lanceolate, erect, about twelve inches long, dark green, smooth, appear in spring. *Flowers,* several, lilac or pale purple, arising from the young corm in autumn, by a long narrow, white tube. *Capsule,* three-celled. *Seeds,* numerous, small, spherical, with a rough brown testa. *Habitat,* moist meadows in this and other European countries.

The growth of the plant has been thus described by Professor Christison: Let the bulb be supposed to be in a state of full perfection, which will presently be seen to occur in the course of June or early in July. Soon afterwards, sometimes even in the end of June, a new bulb, about the size of a grain of wheat, will be found at the lower end of the old one, close to its junction with the radicles or root proper. This little bulb increases rapidly, and at the same time begins to send up a flowering stem without leaves. At length, towards the close of autumn, a long, naked, lilac or purplish, crocus-like flower springs from the ground, still without any leaves. The germen at this time remains at the bottom of the long tube of the corolla under ground; and it continues there till the month of January or February, when at length the leaves for the first time show themselves above ground, and rising, like a bunch of tulip leaves, elevate along with them the germen, consisting of three many-seeded capsules, which ripen their seeds about midsummer. After this the herb speedily dies and withers. While the flower is rising in the autumn, the bulb forming its lower end is little larger than the diameter of the flower-stalk, of which it appears a mere dilatation. But it grows rapidly during the winter. In April it is as big as a chestnut, and in July it attains its greatest magnitude, being about the size of a small apricot. At this period in its growth, when it is a twelvemonth old, and the herb proceeding from it has ripened its seed and is withering, a new bulb begins to appear near its lower end, close to the root proper; and this produces in the autumn a flower, and in spring a bunch of leaves,

like its parent bulb before it. The parent bulb meanwhile, as the new flower rises, gradually becomes more spongy and watery, yet retains its size and form till next April, the second spring of its own existence. But after this it quickly decays, so that by the end of May it consists of a shrivelled leathery substance, attached by a broad, thin, membranous band to the lower part of its progeny, now developed into a perfect bulb about the size of a chestnut. The bulb, whose progress has thus been traced, is therefore biennial, or, according to the views of some, triennial. It sees a part of three successive years, but outlives only two revolutions of each season.

Characters of the Corm.—*Fresh corm about the size of a chestnut, flattened, where it has an undeveloped bud; furnished with an outer brown and an inner yellow coat; internally white, solid and fleshy; yielding when cut a milky acrid and bitter juice. Dried slices about a line thick, moderately indented on one, rarely on both sides, firm, flat, whitish, amylaceous.*

Characters of the Seeds.—*About the size of white mustard seed, very hard, and of a reddish-brown colour.*

Both the corms and the seeds yield their active properties to water, alcohol, diluted spirit, vinegar, and wine. The more important constituents are colchicia and veratria, in combination with gallic acid, fatty matter, a volatile acid, starch, gum, &c. Colchicia closely resembles veratria, but may be distinguished from it by being soluble in water, by not possessing the acridity of veratria, and by not acting as a sternutatory.

EXTRACTUM COLCHICI — Extract of Colchicum. — *Take of fresh colchicum corms, deprived of their coats,* 7 *pounds. Crush the corms; press out the juice; allow the feculence to subside, and heat the clear liquor to* 212°; *then strain through flannel, and evaporate by a water-bath at a temperature not exceeding* 160°, *until the extract is of a suitable consistence for forming pills.*

EXTRACTUM COLCHICI ACETICUM—Acetic Extract of Colchicum.—*Take of fresh colchicum corms, deprived of their coats,* 7 *pounds; acetic acid,* 6 *fluid ounces. Crush the corms, add the acetic acid, and press out the juice; allow the feculence to subside, and heat the clear liquor to* 212°; *then strain through flannel, and evaporate by a water-bath, at a temperature not exceeding* 160°, *to the consistency of a soft extract.*

TINCTURA COLCHICI SEMINIS—Tincture of Colchicum Seed.—*Take of colchicum seed, bruised,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the colchicum for forty-eight hours, in fifteen ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

VINUM COLCHICI — Wine of Colchicum. — *Take of colchicum corm, sliced, dried, and bruised,* 4 *ounces; sherry,* 1 *pint. Macerate the colchicum in the wine for seven days in a closed vessel, with occasional agitation, press and strain through calico; then add sufficient sherry to make one pint.*

Dose.—Of the powdered corm or seeds (seldom given), two to eight grains. Of either of the extracts, half-a-grain to three grains. Of the tincture, ten to thirty minims. Of the wine, ten to thirty minims. In all cases the smaller doses are to be given first and gradually increased, under careful observation of their effects.

Colchicum acts in over-doses as a powerful narcotico-acrid poison, causing severe vomiting and purging, burning pain in the throat, severe colicky pains in the bowels, tenesmus, great debility, a small weak frequent or fluttering pulse, cold extremities, suppression of urine, &c. Sometimes the nervous system is more affected, and there is headache, delirium, and insensibility. It is necessary to administer the preparations of colchicum with great caution, beginning with small doses, and gradually increasing them according to circumstances, not only because different samples of the drug vary in activity, but also because some constitutions are violently affected by comparatively small doses. A dose of two and a-half drachms of the tincture has proved fatal. In poisoning by colchicum, the indications are to give diluents to facilitate the removal of the poison by the vomiting and purging which it causes, to allay irritation by opiates internally and counter-irritants externally. In medicinal doses, colchicum may produce nauseant, depressant, diaphoretic, diuretic, cathartic, sedative, or anodyne effects. In small doses frequently repeated it stimulates the secreting organs ; the mucous membrane of the intestines, the liver, the kidneys, and the skin being more or less affected by it. In full doses it causes nausea, vomiting, and purging, and acts as an arterial sedative ; hypercatharsis, severe bilious vomiting, and salivation have followed such doses. By some, colchicum is believed to increase the quantity of uric acid in the urine, by others to diminish it. Colchicum is chiefly employed in the treatment of gout, and was believed to be the active ingredient of a celebrated nostrum termed *Eau Médicinale*, the property of a French military officer named Husson. Colchicum is generally regarded as a specific for gout ; it frequently allays the pain and shortens an attack ; but it is not infallible, and in many cases fails to afford any great measure of relief ; and at best, it is only a palliative, not a curative remedy. It is said also that its use tends to encourage the frequency of the seizures, whilst its influence over them is gradually diminished. The manifestation of its physiological action is probably not essential to its therapeutical effects. In rheumatism, colchicum is much less efficacious than in gout, and in acute cases it should be given with great caution.

Colchicum has also been employed as a diuretic in dropsies, and as an antiphlogistic in acute inflammatory and febrile diseases ; it has also been employed in hysteria, chorea, tetanus, whooping-cough, jaundice, in the lithic or uric acid diathesis, in chronic bronchial complaints, in obstinate constipation, in certain skin diseases, for the expulsion of tape worm, &c.

Sabadilla—Cevadilla.—Officinal plant : *Asagræa officinalis*, Lindl.; *Hexandria Trigynia.* Officinal part : The dried fruit ; imported from Vera Cruz and Mexico. Officinal preparations : *Veratria, Unguentum Veratriæ.*

Botany.—A bulbous plant. *Leaves*, four feet long, numerous, linear, tapering, smooth, grass-like. *Scape*, rising from the centre of the leaves, naked, simple, six feet high. *Inflorescence*, a straight, dense raceme, eighteen inches long ; flowers, small, white or yellowish-white, polygamous. *Follicles*, three, papery. *Seeds*, scimitar-shaped, winged. *Habitat*, eastern side of the Mexican Andes.

CHARACTERS.—*Fruit about half-an-inch long, consisting of three light-brown papyraceous follicles, each containing from one to three seeds, which are about a quarter of an inch long, blackish-brown, shining, slightly-winged, possessing an intensely acrid bitter taste.*

The seeds as met with in commerce have usually the fruit stalk and the remains of the withered calyx adherent ; they are inodorous, but the powder acts as a powerful sternutatory. The seeds consist chiefly of veratria in combination with gallic acid, cevadic acid, fatty matter, wax, two kinds of resin, and probably another peculiar principle termed Sabadillina.

Veratria—Veratria.—An alkaloid, ($C_{64}H_{52}N_2O_{16}$, or $C_{32}H_{52}N_2O_8$), obtained from cevadilla ; not quite pure.

PREPARATION.—*Take of cevadilla,* 2 *pounds; distilled water ; rectified spirit ; solution of ammonia ; hydrochloric acid ; of each, a sufficiency ; purified animal charcoal,* 60 *grains. Macerate the cevadilla with half its weight of boiling distilled water in a covered vessel for twenty-four hours. Remove the cevadilla, squeeze it, and dry it thoroughly with a gentle heat. Beat it now in a mortar, and separate the seeds from the capsules by brisk agitation in a deep narrow vessel, or by winnowing it gently on a table with a sheet of paper. Grind the seeds in a coffee-mill, and form them into a thick paste with rectified spirit. Pack this firmly in a percolator, and pass rectified spirit through it till the spirit ceases to be coloured. Concentrate the spirituous solution by distillation, so long as no deposit forms, and pour the residue, while hot, into twelve times its volume of cold distilled water. Filter through calico, and wash the residue on the filter with distilled water, till the fluid ceases to precipitate with ammonia. To the united filtered liquids add the ammonia in slight excess, let the precipitate completely subside, pour off the supernatant fluid, collect the precipitate on a filter, and wash it with distilled water till the fluid passes colourless. Diffuse the moist precipitate through twelve fluid ounces of distilled water, and add gradually with diligent stirring sufficient hydrochloric acid to make the fluid feebly but*

persistently acid. Then add the animal charcoal, digest at a gentle heat for twenty minutes, filter, and allow the liquid to cool. Add ammonia in slight excess, and, when the precipitate has completely subsided, pour off the supernatant liquid, collect the precipitate on a filter, and wash it with cold distilled water till the washings cease to be affected by nitrate of silver acidulated with nitric acid. Lastly, dry the precipitate first by imbibition, with filtering paper, and then by the application of a gentle heat.

Rationale.—The first part of the process consists merely in the separation of the seeds from the capsules. Next, by percolation with rectified spirit the ground seeds are deprived of their veratria (in combination with gallic acid), some resin, and colouring matter. By pouring the hot concentrated spirituous solution into cold distilled water, the resin is precipitated, and is then removed by filtration. The filtered liquids contain a gallate of veratria, with impurities; on the addition of ammonia the gallic acid is separated from the veratria, which is precipitated in an impure state. Finally, the veratria is purified by washing with distilled water, in which it is insoluble, by solution in hydrochloric acid, by digestion with charcoal, by filtration, by re-precipitation with ammonia, and again by washing with cold distilled water until all traces of hydrochloric acid are removed, as proved by the nitrate of silver test.

CHARACTERS.—*Pale grey, amorphous, without smell, but, even in the most minute quantity, powerfully irritating the nostrils; strongly and persistently bitter, and highly acrid; insoluble in water, and soluble in spirit and ether, in diluted acids, leaving traces of an insoluble brown resinoid matter. An active poison.*

PURITY TESTS.—*Heated with access of air, it melts into a yellow liquid, and at length burns away, leaving no residue.*

Veratria is an uncrystallisable alkaloid; it reacts as an alkali, and forms neutral salts with acids; it is reddened by strong sulphuric acid, and gives with nitric acid a yellowish solution. The purity test would detect lime or other fixed impurity.

UNGUENTUM VERATRIÆ—OINTMENT OF VERATRIA.—*Take of veratria,* 8 *grains; prepared lard,* 1 *ounce; olive oil,* ½ *fluid drachm. Rub the veratria and the oil together; then mix them thoroughly with the lard.*

Dose.—Of veratria, one-twelfth, cautiously increased to one-sixth, of a grain. Preparations of cevadilla and veratria are to be administered with caution; they are seldom employed as internal remedies.

Cevadilla and the alkaloid veratria act in over-doses as powerful irritant poisons, producing severe pain, vomiting, purging, and other symptoms similar to those of poisoning by colchicum, the treatment in both cases being the same. There is no officinal preparation of cevadilla for internal use, and it is rarely given; but it has been recommended as an anthelmintic in tape worm and ascarides. Veratria is very rarely given internally, although it has been recommended as a substitute for colchicum in gout and

rheumatism, also for the relief of certain painful neuralgic affections, and as an antiphlogistic in inflammatory diseases. When applied to the nostril, even in very minute quantity, it acts powerfully as an sternutatory and errhine. Externally it acts as a topical irritant, producing tingling in the part, and as such has been recommended in rheumatism, in neuralgia, in paralysis, in scrofulous diseases of the joints, in diseases of the eye (taking care to keep it away from the conjunctiva), &c.

Veratrum—White Hellebore.—The rootstock of *Veratrum album* was formerly officinal. The plant grows in Alpine, Pyrenean, and other mountainous localities of Europe; the stem is from one to four feet high; the root consists of numerous fleshy brownish-white fibres, attached to a perennial rhizome, which is fleshy, cylindrical, and placed obliquely in the ground. The plant flowers from June to August, the racemes being paniculate, terminal, and pubescent, and the flowers yellowish-white, and green at the back. The leaves pass obliquely into the sheath, are elliptico-lanceolate, and pubescent on their under surface. The rootstock is usually met with in pieces of two or three inches in length, about half-an-inch in diameter, with the radicles attached; it is dark-coloured externally, and greyish-white internally. All parts of the plant act as acrid poisons, and their active properties are yielded both to water and alcohol. The active constituents are *Veratria*, *Jervin*, gallic and veratric acids, &c. White hellebore acts in over-doses as a powerful acro-narcotic poison, and in smaller doses produces severe vomiting and purging. It is a powerful topical irritant, causing violent sneezing when applied to the nostrils, and a severe burning pain in the mouth when chewed. It is rarely administered internally, nor, indeed, in any manner in the present day. It was formerly given in gout and rheumatism, in mania, melancholia, epilepsy, &c.; and externally in scabies, to destroy pediculi, as an application to certain skin diseases, &c. The dose of white hellebore should not exceed one grain at the outset. The L. P. had a *Vinum veratri*, of which ten to twenty drops might be given, and it entered also into the compound sulphur ointment of that Pharmacopœia.

VERATRI VIRIDIS RADIX.—The dried rhizome of Veratrum Viride, Willd. *Synonym:* Green Hellebore, Swamp Hellebore, Indian Poke. Collected in autumn in the United States and Canada.

Botany.—*Root,* short, bulbous; rhizome, premorse, dark-coloured at base, with numerous radicles diverging from its circumference near the base. *Stem,* strong, two to four feet high. *Leaves,* oval, broad, acuminate, strongly plaited, often ten to twelve inches long. *Inflorescence,* racemose. *Flowers,* numerous, green. *Perianthe* of six parts, ovate, acute. *Stamens* six, anthers extrorse. *Fruit,* a three-celled, many-seeded capsule.

It seems to owe its activity to Veratria, which exists in it as Gallate of Veratria. Officinal preparation: *Tinctura Veratri Viridis.*

TINCTURA VERATRI VIRIDIS—TINCTURE OF GREEN HELLEBORE.—*Take of green hellebore root, in coarse powder, 4 ounces; rectified spirit, 1 pint. Macerate the hellebore for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.*

The therapeutic value of this drug has undoubtedly been much overrated. It requires very great care in its administration to prevent the serious depression and distressing nausea resulting from its use being carried to a dangerous degree. It acts as a sedative and antiphlogistic, but it is very questionable whether the sedative effect induced by it on the circulation is not too dearly bought by the nausea and disagreeable results which it produces.

Dose.—Of the powdered root, one to three grains; and of the tincture, five to twenty minims.

PALMÆ—The Palm Order.—Arborescent plants, chiefly tropical, but extending to a limited extent into temperate climates. Palms furnish many useful products, such as starch, sugar, oil, wax, edible fruits, &c. *Sago* is an important product of this order; it is obtained from many of the plants, by splitting their stems and washing out the starchy substance by means of water. It is mostly obtained from the Moluccas and Sumatra, and is afterwards prepared for commerce in Singapore. It is met with in two forms—either as *pearl sago*, which consists of fine grains; or as *common* or *brown sago*, which is coarser. It consists chiefly of starch, and is employed as a bland, non-stimulating article of diet in the sick room.

SUB-CLASS III.—GLUMIFERÆ.

GRAMINEÆ—The Grass Order.—Herbaceous plants, forming herbage in temperate climates, and sometimes becoming arborescent in tropical countries. The order furnishes most important food substances both for man and animals. Officinal plants: *Triticum vulgare, Hordeum distichon, Secale cereale, Saccharum officinarum.*

Farina Tritici—Flour—Wheat Flour.—*The grain of wheat, Triticum vulgare,* Villars, *ground and sifted.* It is used in the preparation of Cataplasma Fermenti.

Bread.—*Bread made with wheat flour.*

Amylum—Wheat Starch.—Officinal plant: *Triticum vulgare,* Villars, *Plant. Dauph.; Triandria Dignynia;* Common Wheat. Starch, procured from the seed.

Botany.—*Culms,* simple, glaucous, jointed. *Spike,* four-cornered, imbricated. *Spikelets,* generally four-flowered; flowers, distichous. *Glumes,*

two, opposite, equal, ribbed. *Grain*, free, convex externally, marked with a deep furrow internally. *Habitat*, Tartary ; widely cultivated.

Wheat-flour consists of starch, gluten, sugar, gum, and water, in varying proportions. By kneading the flour in water, its starch is washed out, and may thus be separated and collected. Starch constitutes from sixty to seventy per cent., and gluten from ten to twelve per cent. of flour. The latter is left behind after the washing out of the starch, in the form of a greyish-white tenacious mass ; it is a compound substance, consisting of albumen, vegetable fibrine, glutine, and caseine.

CHARACTERS OF STARCH ($C_{12}H_{10}O_{10}$, or $C_6H_{10}O_5$). — *In white columnar masses. When rubbed in a Wedgwood mortar with a little cold distilled water, it is neither acid nor alkaline to test-paper, and the filtered liquid does not become blue on the addition of solution of iodine.*

TEST.—*Mixed with boiling water and cooled, it gives a deep blue colour with iodine.*

It is commonly prepared by steeping the wheat-flour in water in a vat for one or two weeks until it becomes sour ; the acid liquid is then removed, and the impure starch, which forms the residuum, is washed upon sieves, collected by deposition and dried. Starch occurs in the form of white, tasteless, and inodorous granules of different sizes, which, when examined under the microscope, present the appearance of a series of concentric rings surrounding the central point or *hilum.* Starch cells consist of an external diaphanous albuminous coat, which encloses the true gelatinous starch or *amidin.* Starch globules are insoluble in cold water, but may be suspended in it by trituration ; boiling water causes the rupture of the cell-walls by the swelling of their contents, and thus starch becomes soluble in it. Starch is also insoluble in alcohol and in ether. Starch is convertible into dextrine and glucose. Starch produces, with free iodine, a deep-blue colour, due to the formation of *iodide of amidin ;* when this is heated to 200°, the colour disappears, but is restored when the solution cools. Starch is derived from many sources.

GLYCERINUM AMYLI—GLYCERINE OF STARCH.—*Take of starch,* 1 *ounce ; glycerine,* 8 *fluid ounces. Rub them together until they are intimately mixed, then transfer the mixture to a porcelain dish, and apply a heat gradually raised to* 240°, *stirring it constantly until the starch particles are completely broken, and a translucent jelly is formed.*

This preparation, which is about the consistence of an ointment, has been long used on the Continent, but was introduced into this country only a few years ago, by Mr Schacht of Clifton, under the name of "Plasma." It is well suited to replace ointment as a menstruum for applying medicinal substances to the skin, where an oily basis is objectionable, being more cleanly and not liable to become rancid. It does not seem to have as yet met with that attention it deserves.

MUCILAGO AMYLI—MUCILAGE OF STARCH.—*Take of starch,* 120 *grains ; distilled water,* 10 *fluid ounces. Triturate the starch with the water, gradually added, then boil for a few minutes, constantly stirring.*

Medicinally, flour is employed for dusting over excoriated, burned, and inflamed surfaces; it is also an ingredient of *Cataplasma Fermenti.* In the form of bread it enters into *Cataplasma Carbonis,* and is largely used in the preparation of *bread-and-water* and *bread-and-milk* poultices. Bread-crumb is occasionally used in the formation of pills. Starch-powder may be used externally for the same purposes as wheat-flour; the decoction of starch is employed as a demulcent, as a vehicle for enemata, as an antidote in poisoning by iodine. Mucilage of starch enters into all the officinal enemata, except that of tobacco. Starch enters into compound tragacanth powder. Wheat-flour, bread, and starch are far more important as nutritive articles of diet than as articles of medicine and pharmacy.

Hordeum Decorticatum—Pearl Barley.—Officinal plant: *Hordeum distichon,* Linn.; *Triandria Digynia;* Two-rowed, or Long-eared Barley. Officinal part: The husked seeds; cultivated in Britain. Officinal preparation: *Decoctum Hordei.*

CHARACTERS OF THE GRAIN.—*White, rounded, retaining a trace of the longitudinal furrow.*

The husk is removed from barley by passing it through a mill of peculiar construction. When the husk merely is removed, it is known as Scotch, hulled, or pot-barley; but when the seeds are entirely deprived of their integuments, and are furthermore rounded and polished, it is termed pearl-barley. Barley consists of starch, gluten, albumen, uncrystallisable sugar, gum, &c.

DECOCTUM HORDEI—DECOCTION OF BARLEY.—*Take of pearl barley,* 2 *ounces; distilled water,* 1½ *pint. Wash the barley in cold water, and reject the washings; boil the washed barley with the distilled water for twenty minutes in a covered vessel, and strain.*

Dose.—Ad libitum.

Decoction of barley is used as a demulcent drink in febrile and inflammatory diseases, and as a vehicle for other medicines. It is most frequently employed in inflammatory affections of the respiratory and urinary organs. Raisins, sugar-candy, liquorice-root, and slices of lemon, are sometimes added.

Oatmeal—the coarsely-ground seeds, freed from the husks, of *Avena sativa*—is used medicinally in the forms of *gruel* and *porridge,* the former as an emollient vehicle for other medicines, especially in the preparation of enema, the latter as a poultice.

Triticum Repens—Couch Grass, or Dog's Grass.—The rhizome or underground stem of this plant, collected in spring, carefully dried and cut into short lengths, is used, in the form of infusion, in irritable states of the urinary organs with painful micturition.

Ergota—Ergot.—(*Secale cornutum*—Spurred Rye.)—Officinal plant: *Secale cereale,* Linn.; *Triandria Digynia;* Common Rye. Officinal

part: The sclerotium (compact mycelium or spawn) of Claviceps purpurea, *Tulasne,* produced within the paleæ. Illustration, plate 113, *Steph. and Church. Med. Bot.* Officinal preparations: *Extractum Ergotæ Liquidum, Infusum Ergotæ, Tinctura Ergotæ.*

Nobody in the present day doubts the fungoid nature of ergot of rye, however difficult it is to determine the individual fungus. The view of Tulasne that it is only a transitory form, *i. e.,* the stroma or mycelium of Claviceps purpurea, seems to be generally admitted at present, and it has consequently been adopted by the editors of the Pharmacopœia. Wheat and other grains are said to have similar productions.

CHARACTERS.—*Subtriangular, curved, with a longitudinal furrow on the concave side, obtuse at the ends; from one-third of an inch to an inch and a-half in length; of a violet-brown colour on the surface, pinkish within, solid, frangible, fracture short, odour faintly marked, but strong if the powder be triturated with solution of potash.*

Ergot of rye, or spurred rye, so-called from its resemblance in shape to the spur of a cock, has a nauseous, musty odour, and a disagreeable and slightly acrid taste. It is apt to be destroyed by the attack of a species of acarus, which eats out the interior of the grain, leaving only an outer, and medicinally useless, shell; it also spoils by exposure to the atmosphere, by absorbing moisture, swelling, and becoming mouldy. It should therefore be carefully preserved in well-stoppered bottles, and, under any circumstances, should not be too long kept. Ergot may also be adulterated with casts of plaster of Paris, or common paste, made up into the shape of, and coloured to resemble, the true substance. It yields its active properties to boiling water, alcohol, and ether. Ergot contains a fixed oil, a crystallisable fatty matter, saccharine substance, gummy extract, red colouring matter, albumen, phosphates, ergotin, secalia, &c. It is most probable that the active properties of ergot depend more or less on ergotin, secalia, and the fixed oil.

Ergotin is a resinoid substance of a reddish-brown colour, having an acrid bitter taste, and giving out a disagreeable odour when heated. It is soluble in alcohol, but insoluble in ether and in water. It is said to be at least sixty times the strength of ergot, and is possessed of poisonous properties. In spite of its activity, however, doubts have been thrown upon the belief that ergotin is the principle of ergot which induces uterine contraction, because we know that the latter, be what it may, is soluble in water. But, on the other hand, we are aware that ergotin can be rendered soluble through association with other substances.

Secalia (C_3H_9N) is identical with propylamine, and occurs in herring pickle, has a peculiarly disagreeable odour, which is destroyed on meeting with an acid. This is believed by Winckler to be the active ingredient of ergot, but his opinion is not borne out by actual experience.

The *fixed oil* is usually of a reddish-brown colour, though occasionally obtained colourless, possesses a feebly acrid taste, is lighter than water, and is soluble in alcohol, ether, and the alkalies. It is found to exert an action on the uterus similar to that of ergot.

EXTRACTUM ERGOTÆ LIQUIDUM—LIQUID EXTRACT OF ERGOT.—*Take of ergot, in coarse powder,* 1 *pound; ether,* 1 *pint, or a sufficiency;*

distilled water, 3½ pints; rectified spirit, 8 fluid ounces. Shake the ether in a bottle with half-a-pint of the water, and after separation decant the ether. Place the ergot in a percolator, and free it from its oil by passing the washed ether slowly through it. Remove the marc, and digest it in three pints of the water at 160° for twelve hours. Press out, strain, and evaporate the liquor by the heat of a water-bath to nine fluid ounces; when cold, add the spirit. Allow it to stand for an hour to coagulate, then filter. The product should measure sixteen fluid ounces.

INFUSUM ERGOTÆ—INFUSION OF ERGOT.—*Take of ergot, in coarse powder, ¼ ounce; boiling distilled water, 10 fluid ounces. Infuse in a covered vessel for half-an-hour, and strain.*

TINCTURA ERGOTÆ—TINCTURE OF ERGOT.—*Take of ergot, in coarse powder, 5 ounces; proof spirit, 1 pint. Macerate the ergot for forty-eight hours, in fifteen ounces of the spirit, in a close vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of the spirit; afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.*

Dose.—Of the powder (which should be prepared only when required), during parturition, twenty grains, repeated, if necessary, to the third time, at intervals of half-an-hour; for other purposes, five to ten or fifteen grains, three times a-day, for a short time only. It may be given as a powder, mixed with sugar, or in peppermint water. Of the liquid extract, ten to thirty or forty minims. Of the infusion, during parturition, two ounces, repeated, if necessary, at intervals of half-an-hour, three or four times; for other purposes, half-a-fluid ounce to one fluid ounce. Of the tincture, in tedious parturition, thirty minims to one fluid drachm; for other purposes, ten to thirty minims.

Ergot of rye in over-doses occasions nausea, vomiting, colicky pains, headache, and occasionally delirium and stupor. When taken for a length of time, as in bread made with diseased rye, it produces two conditions, termed gangrenous ergotism and convulsive ergotism. In medicinal doses it acts chiefly upon the muscular fibres of the uterus, causing them, especially during or after labour, to contract forcibly and permanently. Its use is chiefly confined to this purpose, for which it is given either during labour or afterwards, either to stimulate the uterus in cases of tedious parturition, to cause the expulsion of the placenta, or to prevent flooding subsequently. Ergot is found to induce contraction of the small arteries generally, hence it is used as a hæmostatic in cases of hæmoptysis, &c., and to diminish congestion, especially in sub-inflammatory affections of the cerebro-spinal membranes. The sub-cutaneous injection of ergotin in cases of hæmoptysis and bleeding from small vessels generally has been lately tried in the Edinburgh Infirmary with very great success. It is injected in doses of three grains and

upwards. Ergot is also employed to cause the expulsion of sanguineous clots, hydatids, and polypi from the uterus, to arrest uterine hemorrhage at other times, or to check leucorrhœa, &c.

Saccharum Purificatum — Refined Sugar. — ($C_{24}H_{22}O_{22}$, or $C_{12}H_{22}O_{11}$.) Officinal plant: *Saccharum officinarum*, Linn.; *Triandria Digynia;* the Sugar Cane. Illustration, plates 33, 34, 35, *Nees, Plant. Med.* Officinal part: The crystallised refined juice of the stem; from plants cultivated in the West Indies and other tropical countries. Officinal preparation: *Syrupus.*

Characters.—*Compact, crystalline, conical loaves; known in commerce as lump sugar.*

Theriaca—Treacle.—The uncrystallised residue of the refining of sugar. *Synonym:* Sacchari Faex, L.

Characters.—*A thick, brown, fermentable syrup, very sweet; not crystallising by rest or evaporation. Specific gravity about* 1·40.

Purity Test.—*Nearly free from empyreumatic odour or flavour.*

SYRUPUS—Syrup.—*Take of refined sugar,* 5 *pounds; distilled water,* 2 *pints. Dissolve the sugar in the water with the aid of heat, and add, after cooling, as much distilled water as may be necessary to make the weight of the product seven pounds and a-half. The specific gravity should be* 1·330.

Sugar is used in medicine as a flavouring adjunct to other remedies, and is itself both nutrient and demulcent. It is also employed as a demulcent antidote in irritant and corrosive poisoning. It is employed in pharmacy for a variety of purposes, such as to impart cohesiveness, to give consistence, to suspend insoluble substances, to preserve certain articles from chemical changes, &c. It enters into syrups, confections, lozenges, powders, pills, mixtures, &c. Treacle is used in the preparation of certain pill masses.

B. *Cryptogameæ, Acotyledoneæ, or Flowerless Plants.*

CLASS III.—ACOTYLEDONES OR ACRO-THALLOGENÆ.

Sub-Class I.—Acrogenæ.

FILICES—The Fern Order.—The plants possess anthelmintic, demulcent, astringent, and other properties. Officinal plant: *Aspidium Filix-mas.*

Filix—Fern Root.—Officinal plant: *Aspidium Filix-mas.*, Swartz; Male Shield Fern. Illustration, plate 271, *Woodv. Med. Bot.* Officinal part: The indigenous rhizome, with the bases of the footstalks and portions of the root fibre, dried; collected in summer. Officinal preparation: *Extractum Filicis Liquidum.*

Botany.—Herbaceous plant. *Rhizome*, perennial, subterraneous, thick, tufted, scaly, with descending roots and ascending leaves or fronds. *Fronds*, three or four feet high, bipinnate, rising in a circle from the tufted rhizome; pinnules, oblong, obtuse, serrated. *Habitat*, indigenous.

CHARACTERS.—*Tufted, scaly, greenish-brown; powder greenish-yellow, with a disagreeable odour, and a nauseous, bitter, somewhat astringent taste.*

The rhizome should be carefully dried and powdered, and be kept from the atmosphere in well-stoppered bottles. The chief constituents of the rhizome are a volatile oil, a fixed oil, resin, starch, gum, tannic acid, &c.

EXTRACTUM FILICIS LIQUIDUM—LIQUID EXTRACT OF MALE FERN. —*Take of male fern, in coarse powder, 2 pounds; ether, 4 pints, or a sufficiency. Pack the male fern closely in a percolator, and pass the ether slowly through it until it passes colourless. Let the ether evaporate on a water-bath, or recover it by distillation, and preserve the oily extract.*

Dose.—Of the powder, sixty to one hundred and eighty grains; of the liquid extract, thirty minims to one fluid drachm, in the form of electuary, emulsion, or pills. It is to be taken with milk in the morning, fasting, and should be followed in an hour or two by a dose of castor oil or other purgative. The liquid extract is frequently called *Ethereal extract*, or *Ethereal oil* of male fern.

Male fern is employed as an anthelmintic, and, when good preparations are employed, is perhaps the most successful remedy in the treatment of tape-worm. It usually acts promptly, and without causing any uneasiness, but occasionally it gives rise to nausea and griping pains.

SUB-CLASS II.—THALLOGENÆ.

Lichenes—The Lichen Order.—Cellular plants growing on stones, on the surface of the earth, or on trees, widely distributed. They possess mucilaginous, nutrient, bitter, astringent, and other properties. Officinal plants: *Cetraria islandica*, various species of *Roccella.*

Cetraria—Iceland Moss.—Officinal plant: *Cetraria islandica*, Acharius, *Lichenogr.* Illustration, plate 205, *Woodv. Med. Bot.* (*Lichen islandicus*). Officinal part: The entire lichen; native of the north of Europe. Officinal preparation: *Decoctum Cetrariæ.*

Botany.—*Thallus*, erect, two to four inches high, foliaceous, dry, leathery, tufted, and irregularly divided; divisions channelled, lobed, fringed. *Apothecia*, or fructifications, brown, shield-like or flat, with elevated border. *Habitat*, mountains of the Old and New World.

CHARACTERS.—*Foliaceous, lobed, crisp, cartilaginous, brownish-white, paler beneath, taste bitter, and mucilaginous. A strong decoction gelatinises on cooling.*

Iceland moss has a faint peculiar odour when fresh, but is almost inodorous when dry. It has a mucilaginous and rather bitter taste;

it forms a whitish-grey powder, and swells up in cold water, to which it yields its mucilaginous and bitter properties. It contains a large quantity of starchy matter in the forms of *lichenin* and *inulin*, the former of which gives a blue colour with iodine, whilst the latter does not; it also contains a bitter principle which has acid properties, and is termed *Cetraric acid.*

DECOCTUM CETRARIÆ—DECOCTION OF ICELAND MOSS—*Take of Iceland moss,* 1 *ounce; distilled water,* 1 *pint. Wash the moss in cold water to remove impurities; boil it with the distilled water for ten minutes in a covered vessel, and strain with gentle pressure while hot. Then pour distilled water over the contents of the strainer until the strained product measures a pint.*

Dose—One to two fluid ounces.

Iceland moss acts as a demulcent non-astringent tonic, and when deprived of its bitter principle, is used as an article of diet. The bitter principle, cetraric acid, has been recommended as a substitute for quinine.

Chondrus Crispus.—Carrageen or Irish Moss is also used for the sake of its nutritive and demulcent properties.

Litmus—A blue pigment, prepared from various species of *Roccella,* DC.

LITMUS PAPER, BLUE.—*Unsized white paper steeped in tincture of litmus, and dried by exposure to the air.*

LITMUS PAPER, RED.—*Unsized paper steeped in tincture of litmus which has been previously reddened by the addition of a very minute quantity of sulphuric acid, and dried by exposure to the air.*

LITMUS TINCTURE.—*Take of litmus, in powder,* 1 *ounce; proof spirit,* 10 *fluid ounces. Macerate for two days in a closed vessel, and filter.*

Litmus, which, with its preparations, is placed in Appendix I. of the Pharmacopœia, is used only as a test for acids and alkalies, the acids giving a red colour with blue litmus, the alkalies restoring the blue colour of reddened litmus.

DIVISION II.—ANIMAL KINGDOM.

The articles of the Materia Medica which are derived from the animal kingdom being comparatively few in number, are here given in alphabetical order.

Hog's Fat—The internal fat of the abdomen of the hog, *Sus scrofa,* Linn. (class MAMMALIA, order *Pachydermata*).

ADEPS PRÆPARATUS—PREPARED LARD.—*Synonym:* Axungia, *Edin. The purified fat of the hog, sus scrofa, Linn.*

PREPARATION.—*Take of the internal fat of the abdomen of the hog,*

perfectly fresh, 14 *pounds. Remove as much of the membranes as possible, cut the fat into small pieces, put it into a suitable vessel with about four gallons of cold water, and, while a current of water is running through the vessel, break up the masses of fat with the hands, exposing every part to the water, so that whatever is soluble may be thus dissolved and carried away. Afterwards collect the washed fat on a sieve or in a cloth, drain away as much as possible of the water, liquefy the fat at a heat not exceeding* 212°, *and strain through flannel, pressing the residue while hot; then put it into a pan heated by steam, and keep it at a temperature a little but not much above* 212°, *stirring it continually, until it becomes clear and entirely free from water; finally strain it through flannel.*

CHARACTERS.—*A soft white fatty substance, melting at about* 100°. *Has no rancid odour; dissolves entirely in ether.*

TESTS.—*Distilled water in which it has been boiled, when cooled and filtered, gives no precipitate with nitrate of silver,*[1] *and is not rendered blue by the addition of solution of iodine.*[2]

Absence of salt[1] and starch.[2]

Adeps Benzoatus—Benzoated Lard.

PREPARATION.—*Take of prepared lard,* 1 *pound; benzoin, reduced to coarse powder,* 160 *grains. Melt the lard by the heat of a water-bath, add the benzoin, and frequently stirring them together, continue the application of heat for two hours; finally remove the residual benzoin by straining.*

Uses are the same as those of simple lard. The benzoin is added to prevent the lard from becoming rancid, which it is very apt to do otherwise.

UNGUENTUM SIMPLEX—SIMPLE OINTMENT.—*Take of white wax,* 2 *ounces; prepared lard,* 3 *ounces; almond oil,* 3 *fluid ounces. Melt the wax and the lard in the oil on a water-bath; then remove the mixture, and stir constantly while it cools.*

Prepared lard is used only externally as an emollient; it forms the basis of nearly all the officinal ointments, enters into the officinal suppositories, and into cantharides plaster. Simple ointment is employed as an emollient, and is usually applied as a healing dressing to blistered surfaces.

Cantharis—Cantharides.—*Cantharis vesicatoria,* De Geer; *Hist. des Insectes.* The beetle, dried; collected in Russia, Sicily, and Hungary. Officinal preparations: *Acetum Cantharidis, Charta Epispastica, Emplastrum Cantharidis, Emplastrum Calefaciens, Liquor Epispasticus, Tinctura Cantharidis, Unguentum Cantharidis.*

CHARACTERS.—*From eight to ten lines long, furnished with two-wing-covers of a shining metallic-green colour, under which are two membranous transparent wings; odour strong and disagreeable; powder greyish-brown, containing shining green particles.* PURITY TEST.—*Free from mites.*

Cantharis vesicatoria—the Blister Beetle, or Spanish Fly—belongs to

the class Insecta and the order Coleoptera ; it is an inhabitant of southern Europe, especially Italy and Spain, and is also met with in France, Russia, Siberia, Germany, Hungary, and elsewhere, those which are now brought to this country being collected chiefly in Russia, Sicily, and Hungary. The insects are found feeding upon the leaves of certain species of *Oleaceæ*, as the ash, privet, and lilac, and of *Caprifoliaceæ*, as the elder and honeysuckle. They are collected in the months of May and June, either in the morning or the evening, when they are less alert. Cloths are spread under the trees, which are then either shaken or beaten by persons whose faces and hands are protected ; the insects fall into the cloths and are immediately killed, either by the vapour of vinegar, or by placing them in air-tight vessels, with or without a little oil of turpentine, or by immersing the cloths containing them in hot vinegar and water, or by other means, and they are then dried. Cantharides are liable to the attack of mites and other insects ; and in order to preserve them from these, they are to be kept in well-stoppered bottles or air-tight boxes, in which a few drops of strong acetic acid, or a little camphor or other preservative, is also placed. The insects may be recognised by the officinal characters ; they are easily reduced to a greyish-brown powder, in which, upon careful examination, however finely it may be divided, the shining green particles of the *elytræ* may be detected, a point of no little importance in medico-legal investigation. The active principle of Cantharides is *Cantharidin*, $C_5H_6O_2$, which may be obtained in white micaceous scales ; when isolated it is insoluble in water, but in the insect it probably exists as a soluble compound, for the active properties are to a certain extent yielded to water ; it is soluble in ether, chloroform, and strong acetic acid, and, to a less extent, in cold alcohol. It is very volatile ; when heated it fuses into a volatile oil, which vaporises at a higher temperature, the white fumes afterwards condensing into acicular crystals. It is exceedingly poisonous, causing violent inflammation in parts touched by it. Besides cantharidin, the beetles contain oily and fatty matter.

Acetum Cantharidis—Vinegar of Cantharides.

PREPARATION.—*Take of cantharides, in powder,* 2 *ounces; glacial acetic acid,* 2 *fluid ounces; acetic acid,* 18 *fluid ounces, or a sufficiency. Mix thirteen fluid ounces of the acetic acid with the glacial acetic acid, and digest the cantharides in this mixture for two hours at a temperature of* 200°*; then transfer the ingredients after they have cooled to a percolator, and when the liquid ceases to pass, pour five fluid ounces of acetic acid over the residuum in the apparatus. As soon as the percolation is complete, subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient acetic acid to make one pint.*

This preparation contains eight times as much cantharides as the tincture. It is a prompt vesicant, but too strong for internal use.

Charta Epispastica—Blistering Paper.

PREPARATION.—*Take of white wax,* 4 *ounces; spermaceti,* 1½ *ounce; olive oil,* 2 *fluid ounces; resin,* ¾ *ounce; Canada balsam,* ¼ *ounce; cantharides, in powder,* 1 *ounce; distilled water,* 6 *fluid ounces. Digest all the ingredients, excepting the Canada balsam, in a water-bath for two*

hours, stirring them constantly, then strain, and separate the plaster from the watery liquid. Mix the Canada balsam with the plaster melted in a shallow vessel, and pass strips of paper over the surface of the hot liquid, so that one surface of the paper shall receive a thin coating of plaster.

An elegant substitute for the clumsy Emplastrum Cantharidis, for which it can in all cases be employed. It should be kept with the stained side covered with fine paper, to be removed immediately before application. It is necessary to make sure that it is closely applied to the cuticle, and this is aided by slightly greasing the skin before putting it on. The name is adopted from the French Codex. It may be convenient to employ paper ruled so as to indicate divisions, each of which is one square inch.

EMPLASTRUM CANTHARIDIS—CANTHARIDES PLASTER.—*Take of cantharides, in powder,* 12 *ounces; yellow wax; prepared suet, of each,* 7½ *ounces; resin,* 3 *ounces; prepared lard,* 6 *ounces. Liquefy the wax, suet, and lard together by a water-bath, and add the resin, previously melted; then introduce the cantharides, mix the whole thoroughly, and continue to stir the mixture while it is allowed to cool.*

EMPLASTRUM CALEFACIENS — WARM PLASTER.—*Take of cantharides, in coarse powder; expressed oil of nutmeg; yellow wax; resin, of each,* 4 *ounces; soap plaster,* 3¼ *pounds; resin plaster,* 2 *pounds; boiling water,* 1 *pint. Infuse the cantharides in the boiling water for six hours; squeeze strongly through calico, and evaporate the expressed liquid by a water-bath, till reduced to one-third. Then add the other ingredients, and melt in a water-bath, stirring well until the whole is thoroughly mixed.*

LIQUOR EPISPASTICUS—BLISTERING LIQUID.—*Synonym:* Linimentum Cantharidis, 1864.—*Take of cantharides, in powder,* 8 *ounces; acetic acid,* 4 *fluid ounces; ether, a sufficiency. Mix the cantharides and acetic acid; pack them in a percolator, and at the expiration of twenty-four hours pour ether over the contents of the percolator, and allow it to pass slowly through till twenty fluid ounces are obtained. Keep it in a stoppered bottle.*

TINCTURA CANTHARIDIS—TINCTURE OF CANTHARIDES.—*Take of cantharides, in coarse powder,* ¼ *ounce; proof spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation, strain, press, filter, and add sufficient proof spirit to make one pint.*

UNGUENTUM CANTHARIDIS—OINTMENT OF CANTHARIDES. *Synonym:* Ceratum Cantharides, *Lond.*—*Take of cantharides, yellow wax, of each,* 1 *ounce; olive oil,* 6 *fluid ounces. Infuse the cantharides in the oil, in a covered vessel, for twelve hours, then place the vessel in boiling water for fifteen minutes, strain through muslin with strong pressure, add the product to the wax, previously melted, and stir constantly while the mixture cools.*

Dose.—Of the tincture, ten minims, cautiously increased to thirty or forty, given in a demulcent drink, such as decoction of barley or linseed. The powder of cantharides is occasionally given internally in doses of half-

a-grain to a grain. For external use, the tincture is sometimes employed as a rubefacient. The plaster of cantharides (vulgarly called fly blister or rising blister) is employed as a vesicant. The plaster is usually kept on from eight to twelve hours, after which it is removed, the vesicle is clipped at its most depending margin, and the part is dressed with spermaceti or simple ointment, or the cuticle may be removed altogether, and the surface be dressed with a thick layer of raw cotton, beneath which it heals rapidly. When a perpetual blister is desired, the part is dressed with the ointment of cantharides, ointment of savin, or other irritant. Sometimes the cantharides plaster is only allowed to remain on for five or six hours, vesication being promoted by the subsequent application of a poultice. Certain precautions are necessary in the application of blisters, especially to children, to aged and debilitated persons, and to persons with a particularly sensitive skin. The charta epispastica is in effect similar to the emplastrum cantharidis. Warm plaster is used as a stimulant and rubefacient. Liquor Epispasticus is used as a prompt vesicant in cases in which rapidity of action is required, or in which either the nature of the part to be affected or the condition of the patient is unsuited to the plaster. It is applied by means of a camel's hair brush, two or three coatings being given when prompt action is required; when scantily applied, it acts as a rubefacient. The acetum may be used for vesication also. Ointment of cantharides is used as a counter-irritant, and as an irritant dressing to blistered surfaces, issues, ulcers, &c.

Antidotes.—No chemical antidote. Remove the poison from the stomach by emetics or the stomach pump, if required; emollient, demulcent, mucilaginous drinks, general and local antiphlogistics, to combat inflammation, and opiates to allay pain.

Cantharides act in over-doses as a powerful irritant poison, causing inflammation of the mucous membrane of the alimentary canal, attended by excruciating pain, vomiting and purging, and the discharge of blood and disorganised tissue. In medicinal doses, cantharides act chiefly upon the genito-urinary organs, stimulating the parts, and causing an increased flow of urine; in over-doses, and in some persons in small doses, or even when applied externally only, they are apt to produce strangury. They have been employed as diuretics, and have been recommended also in incontinence of urine from paralysis of the bladder, in the incontinence of urine of children, in gleet, in leucorrhœa, &c.; but their use internally requires great caution, and they are contra-indicated both internally and externally in inflammatory and irritable states of the genito-urinary organs. They are said to increase the sexual desires, and have been secretly given for that purpose—a practice which is not less dangerous than immoral; for according to Professor Christison, poisonous doses are required to produce the effect. But cantharides are commonly used as external topical irritants, for the purpose of rube-

faction or vesication. They are employed as counter-irritants, derivatives, and local and general stimulants, in the vast number of cases in which such treatment is indicated.

Castoreum—CASTOR—*Castor Fiber*, Linn. (class MAMMALIA, order *Rodentia*). *The Beaver.—The preputial follicles and their secretion, dried, separated from the somewhat shorter and smaller oil sacs which are frequently attached to them; from Hudson's Bay territory.*

CHARACTERS.—*Follicles in pairs, about three inches long, fig-shaped, firm, and heavy, brown or greyish-black; containing a dry resinous reddish-brown or brown, highly odorous secretion, in great part soluble in rectified spirit and in ether.* Officinal preparation: *Tinctura Castorei.*

North American, Canadian, or Hudson's Bay castor, the chief variety of commerce, consists of two sacs, which are united by a ligamentous band; they are reddish-brown and wrinkled. During life, the secretion contained in the follicles is fluid, but it speedily concretes after the death of the animal. When dry, they break with a resinous fracture. The sacs are sometimes empty. Castor has a strong peculiar odour, and a bitter aromatic taste. It contains, besides other ingredients, a volatile oil, and a peculiar white, crystalline, fatty, substance, termed *Castorin*. Castor yields its active properties to alcohol and to ether, but very sparingly so to water.

TINCTURA CASTOREI—TINCTURE OF CASTOR.—*Take of castor, in coarse powder,* 1 *ounce; rectified spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient rectified spirit to make one pint.*

Dose.—Of castor, in powder, or in pill, five to ten grains; of the tincture, one-half to two fluid drachms.

Castor was formerly esteemed as an antispasmodic, in the treatment of nervous, spasmodic, and hysterical cases; but it is seldom used now and is probably inert.

Cera Flava—Yellow Wax.—*Apis mellifica*, Linn. (class INSECTA, order *Hymenoptera*); the Hive Bee. The prepared honeycomb; British and imported.

CHARACTERS.—*Firm, breaking with a granular fracture, yellow, having an agreeable honey-like odour.* PURITY TESTS.—*Not unctuous to the touch; does not melt under* 140°; *yields nothing to cold rectified spirit, but is entirely soluble in oil of turpentine. Boiling water, in which it has been agitated, when cooled, is not rendered blue by iodine.*

Cera Alba—White Wax.—Yellow Wax, bleached by exposure to moisture, air, and light; British and imported.

CHARACTERS.—*Hard, nearly white, translucent.* PURITY TESTS.—*Not unctuous to the touch; does not melt under* 150°. Officinal preparation: *Unguentum Simplex.*

Wax is secreted by glands, or *wax pockets,* placed on the ventral surface of the honey-bee. It is used by the insect in the construction of the

comb, in which the honey is stored. After the honey has been removed, first by dripping, and subsequently by expression, the comb is melted in water, whereby impurities are separated, partly by subsidence and partly by straining, and tolerably pure yellow wax is obtained, and from this white wax is procured by bleaching. Wax that is unctuous to the touch may be suspected to contain suet; if it contained resin it would yield it to cold rectified spirit; if it be not entirely soluble in oil of turpentine, it may be suspected to contain vegetable, earthy, or metallic impurities. Starch would be detected by the iodine test.

Wax acts as an emollient, and has been given internally in cases of ulceration of the bowels; but it is rarely used otherwise than as an external application, and is added to many of the officinal ointments and preparations.

Cetaceum — Spermaceti. — *Physeter macrocephalus*, Linn. (class Mammalia, order *Cetacea*).—The sperm whale, inhabiting the Pacific and Indian Oceans. Nearly pure cetine, separated by cooling and purification from the oil contained in the head.

Characters.—*Crystalline, pearly-white, glistening, translucent, with little taste or odour, reducible to powder by the addition of a little rectified spirit.* Purity Tests.—*Scarcely unctuous to the touch; does not melt under* 100°. Officinal preparation: *Unguentum Cetacei;* enters into the constitution of *Charta Epispastica.*

UNGUENTUM CETACEI—Ointment of Spermaceti.—*Take of spermaceti, 5 ounces; white wax, 2 ounces; almond oil, 1 pint, or a sufficiency. Melt together with a gentle heat, remove the mixture, and stir constantly while it cools.*

Spermaceti ointment is employed as an emollient and cooling application to vesicated and excoriated surfaces.

Coccus—Cochineal.—*Coccus Cacti*, Linn. (class Insecta, order *Hemoptera*). The female insect, dried; reared in Mexico and Teneriffe.

Characters.—*Ovate, plano-convex, about two lines long, wrinkled, black, or greyish-white; yields, when crushed, a puce-coloured powder. The greyish-white insect quickly becomes black when warmed before the fire.* Officinal preparation: *Tinctura Cocci.* Is used in the preparation of Tinctura Cardamomi Composita, and Tinctura Cinchonæ Composita.

In Mexico, Vera Cruz, the Canary Islands, Algeria, and other parts whence the cochineal insects are obtained, large plantations of the Nopal (*Opuntia cochillinifera*) are cultivated for them to feed upon. The insects are carefully reared, and the females are placed upon the cactus tree to bring forth their young. When they arrive at a proper age, and the young female insects have become fecundated, the collection takes place, the insects being swept off the trees and destroyed by immersion in boiling water, and then dried. Cochineal is inodorous, but has a somewhat bitter taste. They contain, besides other constituents, a rich purplish-red colouring matter (*Cochinillin*), which forms the basis of carmine.

TINCTURA COCCI—TINCTURE OF COCHINEAL.—*Take of cochineal, in powder, 2½ ounces; proof spirit, 1 pint. Macerate for seven days in a closed vessel, with occasional agitation, strain, press, filter, and add sufficient proof spirit to make one pint.*

Cochineal was formerly employed as an anodyne and antispasmodic, and was used in neuralgia, whooping-cough, &c.; but it is now employed only as a colouring adjunct to other medicines.

Fel Bovinum—OX BILE—Ox Gall.—The fresh bile of the ox, *Bos Taurus*, Linn. (class MAMMALIA, order *Ruminantia*).

Fel Bovinum Purificatum—Purified Ox Bile. PREPARATION.—*Take of fresh ox bile, 1 pint; rectified spirit, 2 pints. Mix the bile and the spirit, by agitation, in a bottle, and set aside for twelve hours until the sediment subsides. Decant the clear solution, and evaporate it in a porcelain dish by the heat of a water-bath until it acquires a suitable consistence for forming pills.*

CHARACTERS.—*A yellowish-green substance, having a taste partly sweet and partly bitter, soluble in water and in spirit. A solution of one or two grains of it, in about a fluid drachm of water, when treated, first with a drop of freshly-made syrup, consisting of one part of sugar and four of water, and then with sulphuric acid, cautiously added, until the precipitate at first formed is redissolved, gradually acquires a cherry-red colour, which changes in succession to carmine, purple, and violet.*[1]

PURITY TEST.—*Its watery solution gives no precipitate on the addition of rectified spirit.*[2]

[1] Indicative of the presence of bile acids. [2] It therefore contains no mucus.

The gall bladder of the ox contains a greenish-brown, viscid alkaline fluid, which has an unpleasant odour, and a taste which is at first bitter and afterwards sweet. This fluid, when purified by agitation with rectified spirit, and inspissated to the consistence of an extract, constitutes the above purified ox gall. Fresh ox bile contains *glyco-cholic*, and *tauro-cholic acids, cholesterin, mucus,* &c. The tauro-cholic and glyco-cholic acids are both in combination with soda, forming two resinous soaps, viz., the tauro-cholate and glyco-cholate of soda. The presence of bile acids is demonstrated by the change of colour under the action of sulphuric acid and sugar. The mucus is removed by agitation with the rectified spirit.

Dose.—Two to five, ten, or more, grains, either in pill, in capsules, or, dissolved in warm water, as an enema.

Purified ox gall acts in small doses as a tonic, and in larger doses as a gentle laxative. It has been recommended in cases of dyspepsia, in which, without organic lesion, there is vomiting after meals; as a laxative, it is given when the secretion of bile is deficient. It is more commonly used as an adjunct to aperient pill masses.

Hirudo—The Leech.—1. *Sanguisuga medicinalis*, Savigny—the Speckled Leech; and 2. *S. officinalis*, Sav.—the Green Leech; collected in Spain, France, Italy, and Hungary.

CHARACTERS.—*Body elongated, two or three inches long, tapering to each end, plano-convex, wrinkled transversely; back olive-green, with six rusty-red longitudinal stripes.* 1. *Belly greenish-yellow, spotted with black;* 2. *Belly olive-green, not spotted.*

The body of the leech is plano-convex, being round on the dorsal, and flat on the ventral aspect. It tapers towards each end, and is annulated, being composed of seventy to a hundred soft rings of gelatinous consistence. The mouth is triradiate, and is furnished with three jaws, each of which is armed with two rows of teeth. The opposite extremity is furnished with a flattened disk or sucker, which, when attached, serves as a fulcrum for the purposes of locomotion.

Leeches abstract from a drachm to half-an-ounce of blood, according to the kind employed, and their condition at the time, the average loss of blood by each leech, including the subsequent hemorrhage, being about half-an-ounce. Leeches often refuse to bite, and it sometimes requires considerable tact and patience in order to succeed with them. To secure their application, the part to which they are to be applied should be carefully washed, taking care to remove all trace of soap, if that be used, and lastly, if necessary, a little cream or milk may be smeared upon the skin, or a slight puncture may be made with the point of a lancet, so as to tempt them with the taste of blood. The leeches themselves should be taken out of cold water, and gently squeezed in a dry cloth. When it is desirable that a leech should attach itself to a particular spot, it may be directed to it either by means of a glass tube or *leech-glass*, or by placing upon the part a piece of blotting paper, with a hole in it corresponding to the point to be attacked. The atmosphere of the apartment should be cool and pure; for should it be close, over-heated, or loaded with tobacco smoke or other fumes, the leeches will probably not bite. When the healthly leech has gorged itself it will drop off; but if it be desirable to remove it sooner, a drop of water, or a grain or two of sugar or of salt, may be sprinkled upon its head. If it be desirable to take more blood than the leeches can abstract, warm poultices may be applied to the part. In order to arrest the hemorrhage from leech-bites, the wounds should be cleared of clots, and exposed to the air; if that be insufficient, pressure may be made upon them with the points of the fingers, or by pledgets of lint and a bandage; or styptics, such as matico, alum, or tannin, may be applied; or a sharp point of lunar caustic may be inserted for an instant. When these measures fail, the part should be transfixed with a needle and tied. When leeches are to be applied to any of the orifices of the body, great care must be taken to prevent their escape beyond reach. Should a leech be swallowed, port wine or common salt should be given, followed as promptly as possible by an emetic. In the case of a leech escaping into the rectum, an enema of port wine or common salt should be administered. Great care and discrimination is required in the application of leeches to children, and to adults also under certain circumstances. A child should never be put to bed at night until hemorrhage from the leech-bites is thoroughly stopped. When many leeches are applied to a

part, they should be carefully counted after their removal, otherwise one or two, which may not have taken well, may get astray, and cause serious consequences by attacking children or others during sleep. Leeches are employed for the purposes of local depletion, but they act also as derivatives. There are very many cases in which the abstraction of a comparatively small quantity of blood by leeches will afford relief which could not be procured by a general blood-letting.

Isinglass—The swimming bladder or sound of various species of *Acipenser*, Linn., prepared and cut into fine shreds. Isinglass is placed in Appendix I. of the Pharmacopœia, for the preparation of a test solution, by means of which tannic acid may be distinguished and separated from gallic acid, the former giving with it a yellowish-white precipitate.

Mel—Honey—*Apis mellifica*, Linn. (class INSECTA, order *Hymenoptera*)—The Hive Bee.—A saccharine secretion deposited by the insect in the honeycomb; British and imported. Officinal preparations: *Mel Depuratum, Oxymel;* it enters into *Mel Boracis, Confectio Piperis, Confectio Scammonii, Confectio Terebinthinæ, and Oxymel Scillæ.*

CHARACTERS.—*When recently separated from the honeycomb, it is a viscid translucent liquid, of a brownish-yellow colour, which gradually becomes partially crystalline and opaque. It has a peculiar heavy odour, and a very sweet taste.*

PURITY TEST.—*Boiled with water for five minutes and allowed to cool, it does not become blue with the solution of iodine.*

MEL DEPURATUM—CLARIFIED HONEY.—*Take of honey,* 5 *pounds. Melt the honey in a water-bath, and strain, while hot, through flannel, previously moistened with warm water.*

Although by this process the honey is rendered more pure, it is at the same time somewhat injured both in flavour and odour. The purity test would detect the presence of amylaceous adulterations. Honey acts as an emollient, demulcent, and laxative. It is occasionally employed internally in inflammatory affections, and as a vehicle for other medicines; but it is much more commonly used as an article of diet, and with some persons, when so taken, it serves the purpose of a laxative. Fresh honey may cause griping pains and indigestion, and poisonous effects have followed its use when obtained by the bees from deleterious plants.

LAC—MILK.—The fresh milk of the Cow, *Bos Taurus*, Linn.—Milk enters into the preparation of *Mistura Scammonii.* Besides its nutritive qualities, milk acts as an emollient and demulcent, and is useful both as an antidote and as a protecting agent in corrosive and irritant poisoning. Milk is also possessed of diuretic properties, and besides being nutritive, is therapeutically useful in acute and chronic albuminaria. Milk with lime or Carrara water, and milk diet, form excellent adjuvants to the action of astringents in diarrhœa. Milk has lately been proposed as a treatment for diabetes mellitus, and several successful cases have been reported in the journals. Externally, it is also used as a soothing application, in the form of bread-and-milk poultice, and also, mixed with warm water, as an eye-wash.

Oleum Morrhuæ—Cod Liver Oil—*Gadus Morrhua*, Linn. (class Pisces).—The oil extracted from the fresh liver by the application of a heat not exceeding 180°.

Characters.—*Pale yellow, with a slight fishy odour, and bland fishy taste.*

Test.—*A drop of sulphuric acid added to a few drops of the oil on a porcelain slab developes a violet colour, which soon passes to a yellowish or brownish-red.*

The oil is obtained from the livers of other fishes, but chiefly from that of the cod. It is largely manufactured in Newfoundland and in the north of Europe, and also to a considerable extent in this country. It is prepared in a variety of ways, such as by exposing the livers to the influence of the sun and the atmosphere for a considerable time, whereby they undergo putrefaction, and yield their oil spontaneously, or by simply cutting them in pieces and allowing the oil to drain from them, or by heating them in boilers and skimming off the oil as it rises to the surface, or, as is commonly practised in this country, by carefully selecting perfectly fresh, clean, and good livers, washing them, and exposing them to a steam heat not exceeding 180°. The oil which rises to the surface is filtered, and the temperature reduced to about 50°, in order to congeal the solid fat (margarine); this is removed by a second filtration, and the oil is then preserved in air-tight jars. Three varieties of the oil are met with in commerce, *pale yellow*, *pale brown*, and *dark brown*; and of these the dark oil is the most offensive. All the varieties have a peculiar, and at first an offensive, taste and odour, but the pale yellow kind, which alone is officinal, is least offensive. In 100 parts of the pale oil, De Jongh found the following constituents:—Oleic acid, along with a peculiar principle called gaduin, 74; margaric acid, 11·75; glycerine, 10·17; butyric acid, ·07; acetic acid, ·04; various principles contained in bile, about ·32; iodine, ·037; chlorine and bromine, ·148; phosphorus, ·021; with phosphoric and sulphuric acids, lime, magnesia, and soda, each in small quantity, the loss being 3. The three kinds of oil do not differ much in constitution; the lighter oils are said to contain more iodine, bromine, chlorine, phosphorus, and salts; the darker oils more bile, butyric and acetic acids. According to Winckler, the oil does not contain true glycerine, but yields an analogous substance termed propyline or oxide of propyle. The test of the pharmacopœias is directed to determine the presence of bile acids, and inferentially, that it has been prepared from the liver of the fish.

Cod liver oil is now universally used in the treatment of phthisis and other cachectic diseases, accompanied by emaciation and an impoverished state of the blood. Why this oil is superior to others in such cases is not known. It has been suggested that its curative effects may be due to the iodine and bromine which it contains; but that is not a sufficient explanation of its action, although, combined with the nutritive qualities of the oil, these ingredients doubtless play a part. Under favourable circumstances, cod liver oil fattens the patient and enriches the blood. Besides phthisis, it has

been successfully employed in the treatment of tabes mesenterica, of scrofula, of scrofulous diseases of the skin, bones, and joints, of scrofulous ophthalmia, scrofulous abscesses, &c. ; in the treatment of chronic rheumatism, neuralgia, &c. It has also been successfully employed, both internally and topically, in obstinate chronic cutaneous diseases, if associated with scrofulous or other cachectic condition.

Cod liver oil is never relished at first, but by perseverance many patients are able to overcome their dislike to it. The dose to begin with should not be more than a teaspoonful, but it may be gradually raised, as the stomach will bear it, to a tablespoonful or more, three times a-day. Many plans have been recommended in order to disguise the unpleasant taste and odour of the oil, but they are of comparatively little avail, and in some cases they are such as greatly to diminish its good effects. The more simply it is taken the better ; but many patients cannot tolerate it in any form as an internal remedy, and in such cases it may be introduced by inunction, or the liver itself, cooked and seasoned, may be tried.

Moschus—Musk—*Moschus moschiferus,* Linn. (class MAMMALIA, order *Ruminantia*—Native of mountainous regions of Central Asia.—The inspissated secretion from the preputial follicles, dried ; imported from China and India.

CHARACTERS.—*In irregular reddish-black, rather unctuous grains; having a strong, peculiar, very diffusible odour, and a bitter aromatic taste ; contained in a round or slightly oval membranous sac, about two inches in diameter, covered on the outer side with stiff greyish hairs, arranged in a concentric manner around its central orifice.*

Musk is secreted, in the form of viscid fluid, in a small sac or pouch which is peculiar to the male animal, and is situated immediately in front of the preputial orifice. The musk-sac is oval in shape, from two to two and a-half inches long by one and three quarters broad, bare and smooth on one side, and covered with stiff yellowish or greyish hairs on the other. Two kinds of musk are met with, one known as China or Thibet musk, the other as Russian, Siberian, or Kabardine musk. Musk contains a peculiar odorous principle, ammonia, stearine, oleine, cholesterine, numerous salts, &c. In consequence of its high price, it is liable to adulteration. Both the sac and its contents may be false, the former made of the skin from other parts of the animal, the latter consisting of dried blood and other substances mixed with a small quantity of musk. The true sac is known by the aperture, the arrangement of the hairs around it, and the microscopic characters of the hairs themselves.

Dose.—Five to ten grains in pill or emulsion.

Musk acts as a stimulant and antispasmodic, but in consequence of its high price and liability to adulteration it is not much em-

ployed. It has been given in hysteria, epilepsy, chorea, whooping-cough, spasmodic asthma, infantile convulsions (two to five grains as an enema), in low typhoid diseases, &c.

Saccharum Lactis—Sugar of Milk—($C_{24}H_{24}O_{24}$, or $C_{12}H_{24}O_{12}$).—Crystallised sugar, obtained from the whey of milk by evaporation.

CHARACTERS.—*Usually in cylindrical masses, two inches in diameter, with a cord or stick in the axis, or in fragments of cakes; greyish-white, crystalline on the surface and in its texture, translucent, hard, scentless, faintly sweet, gritty when chewed.*

Sugar of milk is chiefly used as a vehicle for heavy and active powders; of itself it produces no appreciable effects. It has been recommended, instead of cane sugar, for sweetening cow's milk, when the latter is administered to infants.

Sevum Præparatum—Prepared Suet—*Ovis Aries*, Linn.—The Sheep.—The internal fat of the abdomen, purified by melting and straining.

CHARACTERS.—*White, smooth, almost scentless; fusible at* 103°.

Prepared suet acts as an emollient, and is sometimes used as a substitute for prepared lard; it enters into the ointment of mercury and cantharides plaster.

Albumen Ovi—Egg Albumen—*The Liquid White of the Egg of Gallus Banckiva, var. domesticus*, Temminck.

The liquid albumen (white) of egg is employed as a demulcent and protecting agent in corrosive and irritant poisoning, and especially as an antidote in poisoning by corrosive sublimate, sulphate of copper, and bichloride of tin. Beat up in skimmed milk, it is often found to be retained by the stomach when the irritable condition of that organ will not tolerate anything else.

Ovi Vitellus—Yolk of Egg—*The Yolk of the Egg of Gallus Banckiva, var. domesticus*, Temminck.

Yolk of egg is of a yellow colour, coagulated by heat, and contains a peculiar albuminous principle named vitellin, which is coagulated by ether, and when in solution gives no precipitate with salts of lead or copper. Its colour is due to a yellow oil containing phosphoric acid; but it contains besides oleine, margarine, and cholesterine, with salts of iron, lime, &c. It is mild and nutritious; is employed in making *Mistura Spiritus Vini Gallici*, and in the formation of various emulsions with oily medicines, such as copaiba, oil of turpentine, &c.

PEPSINA—PEPSINE.—The active digestive principle of the gastric juice of Mammalia. Pepsine may be prepared in a variety of ways, and is obtained from the stomachs of calves and pigs. As used in medicine, it occurs as a nitrogenised, light, amorphous, greyish-white or fawn-coloured powder, soluble in water and in weak spirit. It usually has a

peculiar faint odour, and a bitter nauseous taste ; but when quite pure, is both tasteless and inodorous. It is decomposed by a heat of 120°, and afterwards no longer possesses its digestive properties. Its solutions are precipitated by the salts of lead and mercury, and also by tannic acid and by alcohol, but not by nitrate of silver. Its aqueous solution, when acidulated with hydrochloric, phosphoric, or lactic acid, and aided by a heat of 100°, has the power of digesting and dissolving fibrin and coagulated albumen, whereby its relative purity and strength may be tested. Either from faulty preparation, from decomposition, or from adulteration, much of the pepsine of commerce is inert. It is given in cases of atonic dyspepsia, with the view of supplementing the natural gastric juice.

Dose.—About fifteen grains, taken with meals. A wine of pepsine, consisting of pepsine dissolved in sherry, is kept by most druggists, and may be administered in doses of one to four teaspoonfuls along with each meal.

DIVISION III.—PRODUCTS OF FERMENTATION, OF DESTRUCTIVE DISTILLATION, FOSSIL VEGETABLE PRODUCTS, &c.

Alcohol—Absolute Alcohol—($C_4H_6O_2$, or C_2H_6O).—*Take of rectified spirit,* 1 *pint ; carbonate of potash,* $1\frac{1}{2}$ *ounce ; slaked lime,* 10 *ounces. Put the carbonate of potash and spirit into a stoppered bottle, and allow them to remain in contact for two days, frequently shaking the bottle. Expose the slaked lime to a red heat in a covered crucible for half-an-hour, then remove it from the fire, and, when it has cooled, immediately put the lime into a flask or retort, and add to it the spirit, from which the denser aqueous solution of carbonate of potash, which will have formed a distinct stratum at the bottom of the bottle, has been carefully and completely separated. Attach a condenser to the apparatus, and allow it to remain without any external application of heat for twenty-four hours ; then applying a gentle heat, let the spirit distil until that which has passed over shall measure one and a-half fluid ounce ; reject this, and continue the distillation into a fresh receiver until nothing more passes at a temperature of* 200°.

Characters.—*Colourless, and free from empyreumatic odour. Specific gravity,* 0·795. Tests.—*It is entirely volatilised by heat, is not rendered turbid when mixed with water, and does not cause anhydrous sulphate of copper to assume a blue colour when left in contact with it.*

The object of the above process is to remove the water from the rectified spirit, and so convert the latter into absolute alcohol, which is a limpid, colourless, light fluid, exceedingly volatile, producing intense cold during its evaporation, is highly inflammable, burning with a pale blue smokeless flame, has a pungent and rather agreeable odour, and a burning acrid taste ; it unites with water in all proportions, and by gradually absorbing it from the atmosphere when exposed, it becomes weaker. It has never been frozen. The specific gravity of alcohol affords an indication of its strength and purity ; fixed impurities would remain after volatilisation ; oily substances would render it turbid on the addition of water ; and water, if present, would give rise to a blue

colour with anhydrous sulphate of copper. Alcohol is used only as a solvent and test. It is not employed in any of the officinal preparations, nor is it administered as a medicine, except in so far as it forms the basis of all spirituous liquors; hence it is placed in Appendix I. of the Pharmacopœia, and not in the body of the work.

SPIRITUS RECTIFICATUS—RECTIFIED SPIRIT.—Alcohol ($C_4H_6O_2$, or C_2H_6O), with sixteen per cent. of water; obtained by the distillation of fermented saccharine fluids, and by the rectification of the product, if it be not of the proper density. Officinal preparation: *Spiritus Tenuior.*

CHARACTERS.—*Colourless, transparent, very mobile and inflammable, of a peculiar pleasant odour, and a strong spirituous burning taste. Burns with a blue flame without smoke.*

PURITY TESTS.—*Specific gravity,* 0·838. *Remains clear when diluted with distilled water. Odour and taste purely alcoholic. Four fluid ounces with* 30 *grain-measures of the volumetric solution of nitrate of silver exposed for twenty-four hours to bright light, and then decanted from the black powder which has formed, undergoes no further change when again exposed to light with more of the test.*

Alcohol is obtained from sugar by what is termed *vinous fermentation,* and it may be obtained from any substance which is capable of being converted into (grape or fruit) sugar. Pure sugar dissolved in water does not undergo the change necessary to produce alcohol; it requires the presence of a nitrogenous element called a *ferment.* When sugar (*grape* or *cane,* both of which are probably converted into *fruit-sugar* before the vinous fermentation takes place) is dissolved in water, and maintained at a temperature of from 60° to 80°, in the presence of a ferment such as yeast, a change takes place; effervesence is observed, and when this has ceased, it is found that the fluid no longer contains sugar, but alcohol, carbonic acid gas having escaped. The sugar is resolved into alcohol (51·12) and carbonic acid gas (48·88), the ferment neither adding to nor abstracting from its constituents; thus, grape sugar, $C_6H_{12}O_6 = 2C_2H_6O + 2CO_2$, under the action of the ferment. In the case of cane-sugar, an atom of water requires, in the first instance, to be assimilated, by which means it is converted into grape-sugar, and the fermentation goes on as before, thus, $C_{12}H_{22}O_{11} + H_2O = 2C_6H_{12}O_6$, and then $C_6H_{12}O_6 = 2CO_2 + 2C_2H_6O$. From the fermented fluids, the officinal spirit is obtained by distillation and rectification. The strength of the spirit is shown by its density. The other tests are intended to determine the amount of *grain oil* or *fousel oil* present, a little of which may be detected even in the purest rectified spirit.

SPIRITUS TENUIOR—PROOF SPIRIT.—*Take of rectified spirit,* 5 *pints; distilled water,* 3 *pints. Mix.* PURITY TEST.—*Specific gravity,* 0·920.

Rectified and proof spirit are employed in many pharmaceutical processes. Rectified spirit is employed externally for several purposes, as in the preparation of evaporating lotions, as an application to inflamed surfaces, to skin diseases, to prevent bed sores, &c. In the form of ardent spirits (brandy, whisky, &c.), it is given internally as a vital stimulant in many cases.

Spiritus Vini Gallici—Spirit of French Wine. *Synonym:* Brandy. Spirit distilled from French Wine. It has a peculiar flavour and a light sherry colour.

Brandy contains about 53 per cent. of alcohol, with some volatile oil and œnanthic ether. It is coloured either by the cask on keeping, or with burnt sugar, being almost colourless when distilled.

It is a powerful and agreeable stimulant and restorative, administered in the adynamic stages of continued fevers, and in other low states of the system. It is employed in the preparation of the Mistura Spiritus Vini Gallici.

Mistura Spiritus Vini Gallici—Mixture of Spirit of French Wine. *Synonym:* Egg Flip.

PREPARATION.—*Take of spirit of French wine; cinnamon water, of each, 4 fluid ounces; the yolks of 2 eggs; refined sugar, ½ ounce. Rub the yolks and sugar together, then add the cinnamon water and spirit.*

Dose.—One to two fluid ounces.

This preparation is an excellent stimulant, nutrient, and restorative; very useful, and generally employed both to keep up the circulation and maintain nutrition in low states of the system, as in typhus and typhoid fever, &c. It is popularly termed "egg flip."

Vinum Xericum—Sherry.—A Spanish Wine.

CHARACTERS.—*Pale yellowish brown, containing about seventeen or eighteen per cent. of alcohol.*

Sherry is employed in the preparation of all the officinal wines except three. The exceptions are Vinum Aurantii, Vinum Ferri Citratis, and Vinum Quiniæ. Sherry is also largely used both as a luxury and as a medicine, but it is beyond the scope of the *Note-Book* to enter into the physiological and therapeutical actions of this and other wines.

SPIRITUS PYROXYLICUS RECTIFICATUS—RECTIFIED PYROXYLIC SPIRIT.—Hydrated Oxide of Methyle ($C_2H_4O_2$, or CH_4O), with about ten per cent. of water, a product of the destructive distillation of wood.

CHARACTERS.—*Colourless, mobile, and inflammable, burning with a pale blue flame, having a spirituous odour and a warm ethereal taste, with a peculiar after taste.*

Rectified pyroxylic spirit, or wood spirit, is given in doses of ten to thirty or forty minims, to allay the cough and febrile excitement in phthisis. Dr Hasting's *medicinal naphtha* was supposed to operate as a solvent of tubercle, and was at one time much vaunted as a cure for phthisis. *Methylated spirit* consists of spirit of wine, to which is added ten per cent. of pyroxylic spirit. The object of this mixture was to allow of the sale of a cheap form of spirit for use in arts and manufactures; for it was believed that the spirit of wine, thus rendered disagreeable by the addition of the pyroxylic spirit, could not be used either as a luxury

or for internal administration in any form, and it was therefore allowed to be used free of duty; but more recently an attempt has been made to introduce it into pharmacy for the preparation of tinctures, &c. Pyroxylic Spirit is not now contained in the British Pharmacopœia.

ALCOHOL AMYLICUM — AMYLIC ALCOHOL.—*Synonym:* Fousel Oil.—*Amylic Alcohol* ($C_{10}H_{12}O_2$, or $C_5H_{12}O$), *with a small proportion of other spirituous substances.*

An oily liquid, contained in the crude spirit produced by the fermentation of saccharine solutions with yeast, and separated in the rectification or distillation of such crude spirit.

CHARACTERS AND TESTS.—*A colourless liquid, with a penetrating and oppressive odour, and a burning taste. When pure its specific gravity is* ·818, *and its boiling point* 270°. *Sparingly soluble in water, but soluble in all proportions in alcohol, ether, and essential oils. Exposed to the air in contact with platinum-black it is slowly oxidised, yielding valerianic acid.*

Fousel oil, or oil of grain, being less volatile than pure spirit, is left behind in the process of distillation, after the spirit has been drawn off; it may be obtained from the residual liquor by continuing the distillation. As stated in the Pharmacopœia, it is converted by oxidation into valerianic acid, for which purpose it is used in the preparation of the valerianate of soda.

Æther—Ether.—*Synonym:* Æther Sulphuricus, *Ed. Dub.*—A volatile liquid prepared from alcohol, and containing not less than 92 per cent. by volume of pure ether (C_4H_5O or $C_4H_{10}O$).

PREPARATION.—*Take of rectified spirit,* 50 *fluid ounces; sulphuric acid,* 10 *fluid ounces; chloride of calcium,* 10 *ounces; slaked lime,* ½ *ounce; distilled water,* 13 *fluid ounces. Mix the sulphuric acid with twelve fluid ounces of the spirit in a glass matrass capable of containing at least two pints, and, not allowing the mixture to cool, connect the matrass by means of a bent glass tube with a Liebig's condenser, and distil with a heat sufficient to maintain the liquid in brisk ebullition. As soon as the ethereal fluid begins to pass over, supply fresh spirit through a tube into the matrass in a continuous stream, and in such quantity as to equal the volume of the fluid which distils over. For this purpose use a tube furnished with a stopcock to regulate the supply, connecting one end of the tube with a vessel containing the spirit raised above the level of the matrass, and passing the other end through a cork fitted into the matrass. When the whole of the spirit has been added, and forty-two fluid ounces have distilled over, the process may be stopped. Dissolve the chloride of calcium in the water, add the lime, and agitate the mixture in a bottle with the impure ether. Leave the mixture at rest for ten minutes, pour off the light supernatant fluid, and distil it with a gentle heat until a glass bead of specific gravity* 0·735 *placed in the receiver begins to float. The ether and spirit retained by the chloride of calcium and by the residue of each rectification may be recovered by distillation, and used in a subsequent operation.*

Rationale.—Alcohol consists of C_2H_6O; ether consists of $C_4H_{10}O$. The object of this process is to abstract one atom of water from two atoms of the former, in order to convert it into the latter. The process, termed

etherification, has been explained in several ways, all of which are much more complex than would at first sight seem necessary for so simple an object. The theory more commonly adopted is as follows:—When the alcohol and the sulphuric acid are treated as directed in the first part of the process, a compound is formed, which is called *Sulphovinic Acid,* ($C_2H_5HSO_4$), thus: $H_2SO_4 + C_2H_5HO = C_2H_5HSO_4 + H_2O$. In the second stage of the process, the newly-formed sulphovinic acid, and a new atom of alcohol, undergo double decomposition, ether being produced, and the sulphuric acid set at liberty to act upon a fresh atom of alcohol, thus: $C_2H_5HSO_4 + C_2H_5HO = C_4H_{10}O + H_2SO_4$. Pure ether distils over only when the temperature of the boiling point is kept within a certain range, a matter which is determined by the relative proportions of alcohol and sulphuric acid in the retort. The temperature to be aimed at is about 285°, and it is in order to maintain this that the continuous stream of fresh spirit is directed to be added; for if it were not so, the temperature of the boiling point would gradually rise as the quantity of spirit diminished, until it arrived at 320°, when empyreumatic products (olefiant gas, heavy oil of wine, &c.) would pass over and contaminate the distillate. On the other hand, if the spirit were added too freely, so as to reduce the temperature of the boiling point below 260°, alcohol would distil over instead of ether. The sulphuric acid is sufficient for the etherification of all the alcohol, and therefore does not require to be renewed. The subsequent part of the process, with the chloride of calcium and slaked lime, is simply for the purification of the ether, by removing any alcohol, water, sulphuric or sulphurous acids, heavy oil of wine, &c., which may have passed over.

CHARACTERS.—*A colourless very volatile and inflammable liquid, emitting a strong and characteristic odour, and boiling below* 105°.

PURITY TESTS.—*Specific gravity,* 0·735.[1] *Fifty measures agitated with an equal volume of water are reduced to* 45 *by an absorption of* 10 *per cent.*[2] *It evaporates without residue.*[3]

[1] If water, or other impurities, were present, the density would be correspondingly increased. [2] The water dissolves 10 per cent. of the ether. [3] Absence of fixed impurities. Ether should be neutral, but when exposed it soon becomes acid.

SPIRITUS ÆTHERIS—SPIRIT OF ETHER.—*Take of ether* 10 *fluid ounces; rectified spirit,* 1 *pint. Mix.* PURITY TEST.—*Specific gravity,* 0·809.

Dose.—Of ether, twenty minims to one fluid drachm; of the spirit, thirty minims to two fluid drachms.

Ether acts as a powerful but transient diffusible stimulant. It is usually given in spasmodic and nervous cases, and in those in which it is necessary to arouse the vital energies promptly. It was formerly commonly used as a general anæsthetic, and is still so employed to a considerable extent in the United States of America, but in this country it has been almost entirely superseded by chloroform for that purpose. When applied externally, in consequence of

its rapid evaporation, it produces intense cold, a property which Dr Richardson has turned to advantage in the employment of ether spray as a local anæsthetic. When its evaporation is prevented by a covering, it acts as a rubefacient. Ether is employed as a solvent in several of the officinal preparations.

ÆTHER PURUS—PURE ETHER.—Ether (C_4H_5O, or $C_4H_{10}O$), free from alcohol and water.

PURIFICATION.—*Take of ether; distilled water, of each,* 2 *pints; lime, recently burned,* $\frac{1}{4}$ *ounce; chloride of calcium,* 4 *ounces. Put the ether with one pint of the water into a bottle, and shake them together; allow them to remain at rest for a few minutes, and when the two liquids have separated, decant off the supernatant ether; mix this with the remainder of the water, and again, after separation, decant as before. Put now the washed ether, together with the lime and chloride of calcium, into a retort to which a receiver is closely attached, let them stand for twenty-four hours, then distil with the aid of a gentle heat.*

PURITY TEST.—*Specific gravity not exceeding* 0·720.

In this process the water washes out the alcohol, and that part of the water which is taken up by the ether is subsequently removed by the lime and chloride of calcium. Pure ether is used only as a test, and in the preparation of aconitia, and some other alkaloids.

SPIRITUS ÆTHERIS NITROSI—SPIRIT OF NITROUS ETHER.—*Synonym:* Spiritus Ætheris Nitrici, *Lond.*, *Edin.*, Sweet Spirits of Nitre. A spirituous solution containing nitrous ether (C_4H_5O,NO_3, or $C_2H_5NO_2$).

PREPARATION.—*Take of nitric acid,* 3 *fluid ounces; sulphuric acid,* 2 *fluid ounces; copper, in fine wire (about No.* 25), 2 *ounces; rectified spirit, a sufficiency. To one pint of the spirit add gradually the sulphuric acid, stirring them together; then add, in the same way, two and a-half fluid ounces of the nitric acid. Put the mixture into a retort or other suitable apparatus, into which the copper has been introduced, and to which a thermometer is fitted. Attach now an efficient condenser, and applying a gentle heat, let the spirit distil at a temperature commencing at* 170° *and rising to* 175°, *but not exceeding* 180°, *until twelve fluid ounces have passed over and been collected in a bottle kept cool, if necessary, with ice-cold water; then withdraw the heat, and having allowed the contents of the retort to cool, introduce the remaining half ounce of nitric acid, and resume the distillation as before, until the distilled product has been increased to fifteen fluid ounces. Mix this with two pints of the rectified spirit, or as much as will make the product correspond to the tests of specific gravity and per-centage of ether separated by chloride of calcium. Preserve it in well-closed vessels.*

CHARACTERS.—*Transparent and nearly colourless, with a very slight tinge of yellow, mobile, inflammable, of a peculiar penetrating apple-like odour, and sweetish cooling sharp taste. When agitated with solution of sulphate of iron and a few drops of sulphuric acid it becomes deep olive-brown or black.*

PURITY TESTS.—*Specific gravity,* 0·845. *It effervesces feebly, or not at all, when shaken with a little bicarbonate of soda. If it be agitated with*

twice its volume of saturated solution of chloride of calcium in a closed tube, two per cent. of its original volume will separate in the form of nitrous ether, and rise to the surface of the mixture.

Dose.—One-half to two fluid drachms.

Rationale.—The object of this process is to cause ether and nitrous (hyponitrous) acid to pass over with rectified spirit into the receiver. The copper, being oxidised at the expense of the nitric acid, thereby converts the latter into nitrous acid, HNO_2. The sulphuric acid partly combines with the oxide of copper to form sulphate ($CuSO_4$) and water, and partly converts the alcohol into ether, $C_4H_{10}O$, as shown in the process for making ether. The ether and nitrous acid formed in this manner combine to form nitrous ether, thus: $C_4H_{10}O + 2HNO_2 = 2C_2H_5NO_2 + H_2O$. The nitrous ether distils over, mixed with spirit. The greatest caution must be observed throughout not to allow the temperature to rise too high, as, at even moderate temperatures nitrous acid is apt to react violently upon alcohol; hence the necessity of interrupting the process, and cooling the contents of the retort. Nitrate of soda, from which nitrous ether was wont to be prepared officinally, is a very uncertain salt, and consequently, led to corresponding variations in the composition of the spirit of nitrous ether formed from it.

Spirit of nitrous ether is frequently met with in an impure state, sometimes the consequence of direct adulteration, at others proceeding either from faulty preparation or from not carefully preserving it. Water and some other impurities would be detected by any alteration of density, free acid by effervescence with bicarbonate of soda, and the proper amount of nitrous ether by the last of the above tests.

Dose.—Thirty minims to two or three fluid drachms.

Spirit of nitrous ether acts as a diuretic, diaphoretic, and refrigerant. As a diuretic it is given, in combination with other remedies of a similar tendency, in dropsies; as a refrigerant and diaphoretic it is given with solution of acetate of ammonia in febrile cases.

Chloroformum—Chloroform.—C_2HCl_3, or $CHCl_3$. Officinal preparations: *Linimentum Chloroformi, Spiritus Chloroformi.*

PREPARATION.—*Take of chlorinated lime,* 10 *pounds; rectified spirit,* 30 *fluid ounces; slaked lime, a sufficiency; water,* 3 *gallons; sulphuric acid, a sufficiency; chloride of calcium, in small fragments,* 2 *ounces; distilled water,* 9 *fluid ounces. Place the water and the spirit in a capacious still, and raise the mixture to the temperature of* 100°. *Add the chlorinated lime and five pounds of the slaked lime, mixing thoroughly. Connect the still with a condensing worm encompassed by cold water, and terminating in a narrow-necked receiver; and apply heat so as to cause distillation, taking care to withdraw the fire the moment that the process is well established. When the distilled product measures fifty ounces, the receiver is to be withdrawn. Pour its contents into a gallon-bottle half-filled with water, mix well by shaking, and set at rest for a few minutes, when the mixture will separate into two strata of different densities. Let the lower stratum, which*

constitutes crude chloroform, be washed by agitating it in a bottle with three ounces of the distilled water. Allow the chloroform to subside, withdraw the water, and repeat the washing with the rest of the distilled water in successive quantities of three ounces at a time. Agitate the washed chloroform for five minutes in a bottle with an equal volume of sulphuric acid, allow the mixture to settle, and transfer the upper stratum of liquid to a flask containing the chloride of calcium mixed with half-an-ounce of slaked lime, which should be perfectly dry. Mix well by agitation. After the lapse of an hour connect the flask with a Liebig's condenser, and distil over the pure chloroform by means of a water-bath. Preserve the product in a cool place, in a bottle furnished with an accurately ground stopper.

The lighter liquid which floats on the crude chloroform after its agitation with water, and the washings with distilled water, should be preserved, and employed in a subsequent operation.

Rationale.—The changes which take place in the preparation of chloroform are exceedingly complex, and some of the ingredients employed, although essential to the process, seem to perform only secondary duties, and are not seen in the conversion of the alcohol into chloroform. The following explanation, condensed from Attfield's "Chemistry," represents the most probable nature of the reaction in its main features.

The hypochlorite of calcium, in the chlorinated lime, parts with oxygen and chlorine, to act upon the alcohol, its calcium being liberated as hydrate of calcium, $CaCl_2O_2 + H_2O = CaH_2O_2 + O + Cl_2$. The oxygen acting upon the alcohol probably converts it, in the first instance, into aldehyd (C_2H_4O), thus: $C_2H_6O + O = C_2H_4O + H_2O$. The aldehyd, in the next place, being acted upon by the chlorine, is converted into chloral (C_2HCl_3O), and hydrochloric acid, thus: $C_2H_4O + 6Cl = C_2HCl_3O + 3HCl$. The hydrochloric acid is at once neutralized by some of the liberated hydrate of calcium, so as to form chloride of calcium and water, thus: $CaH_2O_2 + 2HCl = CaCl_2 + 2H_2O$; whilst another portion of the hydrate of calcium reacts upon the chloral so as to form chloroform and formiate of calcium, $Ca(CHO_2)_2$, thus: $2C_2HCl_3O + CaH_2O_2 = Ca(CHO_2)_2 + 2CHCl_3$. Or, neglecting the probable intermediate steps, and regarding simply the materials and the products, four molecules of alcohol and eight of hypochlorite of calcium yield two of chloroform, three of formiate of calcium, five of chloride of calcium, and eight of water, thus: $4C_2H_6O + 8CaCl_2O_2 = 2CHCl_3 + 3Ca(CHO_2)_2 + 5CaCl_2 + 8H_2O$. The subsequent part of the process is intended for the purification of the chloroform.

CHARACTERS.—*A limpid colourless liquid, of an agreeable ethereal odour, and sweet taste. Dissolves in alcohol and ether in all proportions; and slightly in water, communicating to it a sweetish taste. Burns, though not readily, with a green and smoky flame.*

PURITY TESTS.—*Specific gravity* 1·49. *Is not coloured by agitation with sulphuric acid, leaves no residue and no unpleasant odour after evaporation.*

Chloroform is transparent, heavy, oily, and exceedingly volatile; its odour somewhat resembles that of ripe apples, and it has a sweet but burning taste. It is a powerful solvent, and is itself readily soluble in alcohol and in ether, but only to a slight extent in water. It has gene-

rally been looked upon as the terchloride of the triatomic radical formyle, $CHCl_3$, obtained by the substitution of chlorine for the oxygen of the teroxide of formyle, or formic acid, anhydride ($C_2H_2O_3$), and was so named in consequence of its being a product of the destructive distillation of the ant, or *Formica rufa.* Chloroform is decomposed by the mineral acids and by the caustic alkalies. The purification of chloroform by sulphuric acid, although serviceable at the time, is believed to render it more liable to change afterwards, with the production of an acid reaction and a suffocating odour. Chloroform may contain several impurities, chiefly the result of faulty preparation or carelessness in the manner of preserving it; the chief impurities are alcohol, ether, hydrochloric or sulphuric acid, chloral, heavy volatile oils, &c. When dropped into water it sinks immediately in the form of rounded globules, which should not become opalescent, as they would do if alcohol were present.

LINIMENTUM CHLOROFORMI—Liniment of Chloroform.—*Take of chloroform, liniment of camphor, of each* 2 *fluid ounces. Mix.*

SPIRITUS CHLOROFORMI—Spirit of Chloroform.—*Take of chloroform,* 1 *fluid ounce; rectified spirit,* 19 *fluid ounces. Dissolve.*

Purity Test.—*Specific gravity,* 0·871.

Tinctura Chloroformi Composita — Compound Tincture of Chloroform.

Preparation.—*Take of chloroform,* 2 *fluid ounces; rectified spirit,* 8 *fluid ounces; compound tincture of cardamoms,* 10 *fluid ounces. Mix.*

This is a convenient and agreeeble form of administering chloroform internally. It is to be distinguished from the spirit of chloroform, which contains only 1 of chloroform in 20 parts, whereas the present preparation contains 1 of chloroform in 10 parts, and nearly corresponds in strength to the old chloric ether.

Dose.—Of fluid chloroform, five to thirty minums in water, suspended by means of mucilage. Spirit of chloroform is the officinal substitute for *Chloric Ether,* which was an uncertain preparation. It has a sweet taste and fragrant odour; it is given as a stimulant and antispasmodic in doses of twenty minims to a fluid drachm, and is miscible with water. The compound tincture is administered in doses of ten to forty minims. Liniment of chloroform is used externally as an anodyne.

Antidotes.—To prevent the supervention of dangerous symptoms, chloroform should be administered to the patient in the recumbent position. The clothes should be carefully loosened, and an abundance of air ought to be inhaled along with the vapours of the drug. When symptoms of poisoning are observed during its administration, its application should be immediately stopped, and the patient exposed to a current of fresh cool air; the tongue may be drawn forward, and artificial respiration and galvanism be resorted to, if necessary. Dashing cold water upon the patient, friction, stimulants to the nostrils, and other remedial measures, have been recommended. (The subject of chloroform as an anæsthetic, the mode of its application, the quantity to be given, the dangers which

attend its use, &c., is so extensive, belongs to so many departments of the healing art, and has been the subject of so much controversy, that I have thought it better not to enter upon it here at all, rather than to give only a partial view of it, which might produce imperfect or erroneous impressions.)

Chloroform, administered in the fluid form, acts as a sedative and narcotic, producing in over-doses symptoms somewhat resembling those of alcoholic poisoning. When applied externally undiluted, it acts as a counter-irritant, but as an anodyne when diluted. When given in the form of vapour, it acts as an antispasmodic and anæsthetic. It has been recommended internally in cases of neuralgia, in protracted vomiting, in painful and irritable states of the stomach and bowels, in flatulent colic, in lead colic, in spasmodic asthma, in bronchitis and hooping-cough, in hysteria, in delirium tremens, in rheumatism, in tetanus, in dysmenorrhœa, in sea-sickness, &c., &c. As a topical application, it is used to allay neuralgia, toothache, rheumatic and other pains, to allay the itching of certain skin-diseases, dropped into the ear to relieve otalgia, &c. As an anæsthetic it is employed in surgical operations, in midwifery, in convulsions, uræmic, and otherwise, &c., &c. There does not appear to be a single authenticated case of death from chloroform in midwifery when the drug was administered by a qualified medical man. During labour it ought not to be administered continuously or deeply, but simply during the pains, and suspended for the time as each contraction subsides. It should not be given till nearly the conclusion of the first stage of labour. In dentistry practice, in which chloroform has proved most fatal, the untoward results are probably partly due to the necessity of operating in the semi-erect position. But there seems reason to believe that they are also partly referable to the formation of a clot in the larynx, and consequent suffocation. During such operations it is therefore absolutely necessary to see that the throat is kept free of clots; and possibly the best means of avoiding their formation is rapidity of operation, and getting the patient quickly forward so as to clear the mouth. The administration of chloroform is certain to be followed by sickness and vomiting if the patient has partaken of food shortly before commencing its inhalation. But the vomiting is in a great measure preventible by forbidding the patient to take food for four hours previously to the operation. Dr Thomas Keith finds that a mixture of chloroform and ether is much less liable to be followed by sickness than pure chloroform. Chloroform should never be adminis-

tered through an inhaler, but simply by means of a handkerchief or towel, which, while it admits free access of air along with the chloroform, permits of being removed the instant it is necessary to suspend the administration. Whatever diversity of opinion may still exist as to the value of chloroform, and the restrictions which ought to be placed upon its use, and however keenly opinions may from time to time have been contested, there has never been a period at which the profession withheld the well-merited expression of its approbation towards the distinguished founder of its reputation, the late Professor Sir James Young Simpson, Bart.

CHLORAL — ANHYDROUS CHLORAL.—This substance, which has the composition $C_4HCl_3O_2$, or $C_2H\ Cl_3O$, was discovered as a chemical product by Liebig in 1832, but its valuable therapeutical properties were unknown till discovered by Dr Otto Liebreich, of Berlin, about two years ago. It is most easily prepared by saturating anhydrous alcohol with well-dried chlorine gas, when hydrochloric acid is evolved and chloral formed; thus, $C_2H_6O + Cl_8 = C_2HCl_3O + 5HCl$. If diluted alcohol be employed, aldehyd and hydrochloric acid are produced, but no chloral. To obtain it pure, the alcohol is subjected to the action of chlorine so long as any of it is absorbed, and this is usually many hours. The alcohol is kept at first cool, but is afterwards gradually heated to the boiling point. The crude product is then mixed with three times its bulk of sulphuric acid, and distilled at a gentle heat. This is repeated, and, finally, the chloral is distilled from quicklime. The name chloral was intended to indicate its origin from *chlor*ine and *al*cohol.

So prepared, it is a colourless, oily-looking liquid, having a peculiar pungent odour, emitting fumes which cause a flow of tears, and when dropped upon paper it leaves a greasy stain. Applied to the skin, it is caustic. Its boiling point is 210°, and it distils over unchanged. It has no acid reaction, and gives no precipitate with nitrate of silver, but is decomposed by the caustic alkalies into *chloroform* and *formiates* of the alkalies. Its specific gravity is 1·502. It is freely soluble in water, alcohol, and ether. When kept for a few days in dry air, it spontaneously forms a tough, white, porcellanous-looking mass, which is isomeric with the liquid form, but insoluble in water, alcohol, and ether, and can be reconverted into the liquid form by distillation. Exposed to moist air, or directly mixed with a small quantity of water, it forms

The Hydrate of Chloral, which is permanent in air, is very soluble, and is the form in which chloral is employed in medicine.

The *Hydrate of Chloral* has the composition $C_4HCl_3O_2 + 2HO$, or $C_2HCl_3OH_2O$, and is usually met with in white crystalline masses, but it can also be got both in acicular and rhomboidal crystals, the latter having two atoms of water of crystallisation. Its specific gravity is 1·57. It is permanent in air, and readily soluble in water, alcohol, and ether. When heated it melts, and boils at 200°. Its solutions have a bitter, very disagreeable taste, which is best covered by addition of syrup of orange and a few drops of peppermint water. Besides forming the

hydrate, chloral combines directly with the alcohols of the ethylic series, forming alcoholates of chloral, which have a great resemblance to the hydrate. The alcoholate of ethyl ($C_2HCl_3OC_2H_6O$) which is formed, with the development of heat, when one equivalent of chloral is mixed with one equivalent of alcohol, is a crystalline mass very similar to the hydrate of chloral, and which is sometimes substituted for it. It is, however, not nearly so readily soluble in water. Specific gravity, 1·34. It melts at 104°, and boils at from 239° to 240·4°. It is said to be inferior to the hydrate as a therapeutic agent.

The therapeutical importance of the hydrate of chloral was first pointed out by Dr Otto Liebreich of Berlin, in a paper communicated to the Medical Society of that city in June 1869. Since that period it has attracted very great attention, and the results of varied and extensive trials with it in different parts of the world have been so very successful that it must be reckoned as one of the most useful medicines known. Dr Liebreich having observed that when acted upon by an alkali it was decomposed into chloroform and formic acid, was led to try it medicinally, believing that its chloroform, being gradually set free in small quantity by the alkali in the blood, would thus exert a continuous hypnotic action. But though free alkalies decompose chloral, the alkaline salts which exist in the blood, as proved experimentally by Dr Arthur Gamgee, do not decompose it; whilst, moreover, the effect of a given amount of chloral is utterly disproportioned to what could be expected from the quantity of chloroform obtainable from it, so that we are forced to confess, in spite of Dr Richardson's opinion to the contrary, that Dr Liebreich's theory is untenable, and that chloral must act in a special manner, and not as a simple producer of chloroform.

Dr B. W. Richardson gives the following summary of the physiological effects of Chloral Hydrate :—

1. Deep and prolonged narcotism can be safely produced by the hydrate of chloral.
2. During a portion of the period of narcotism there may be complete anæsthesia, with absence of reflex actions, and a condition in which every kind of operation fails to call forth consciousness.
3. During the narcotism there are intervals of apparent exalted sensibility.
4. In the transition from drowsiness to stupor, there is no stage of muscular excitement ; but in birds there is vomiting, as is common in the same animal in the second stage of narcotism under chloroform.

5. During the narcotism produced by the substance, there is invariable reduction of temperature.
6. It produces muscular relaxation, which relaxation extends to the muscles of volition, and alike to the iris and the muscular arterial system. From the condition of the muscles after death, we may infer that this paralysis is in part due to change within the muscular structure itself.
7. The action of the substance on the nervous system is principally on the sympathetic ganglia, afterwards on the cerebrum, and finally on the heart.
8. Recovery, when it takes place, is followed by no bad results.
9. In fatal cases, the functions destroyed are, 1*st*, the cerebral; 2*nd*, the voluntary muscular; 3*rd*, the respiratory; 4*th*, the heart.
10. The substance in small proportion averts in some degree the coagulation of the blood, and in large quantities stops the power of coagulation altogether. In large quantities it also destroys the blood corpuscles, and produces general destruction of blood; but the dose required to produce extreme narcotism need not be so large as to lead to serious derangement of blood.
11. The phenomena observed correspond with those observed under chloroform, and the balance of evidence is that they are the result of the action of chloroform.

Some fatal cases have resulted from the administration of hydrate of chloral. The symptoms of an over-dose are coldness of the extremities; pulse excessively rapid, weak, irregular, and intermittent; an intolerable sense of sinking, and oppression at the pit of the stomach. Dr J. R. Reynolds, in a case which he reports in the *Practitioner* for March 1870, noticed that, while the pulse was very irregular, the heart acted quite regularly, though with increased frequency and diminished force; and that the symptoms, after yielding for more than an hour to the administration of stimulants with white of egg, and the application of sinapisms to the region of the heart, returned with increased severity, but disappeared when the same treatment was persisted in for some time. Liebreich has found, from his experiments on animals, that strychnia is its physiological antidote; and Professor Bennett has shown, conversely, that hydrate of chloral is the physiological antidote to strychnia poisoning.

Therapeutically, hydrate of chloral is an anæsthetic, hypnotic, sedative, and antispasmodic.

As an *anæsthetic* it is of very little value, the amount of anæsthesia which it produces being both too slight and of too short continuance to warrant its replacing the more powerful and more certain anæsthetics with which we are already acquainted.

But as an *hypnotic* it is perhaps the best which we possess, not excepting opium, over which it has the very manifest advantage of being entirely without stimulant action, and of producing no subsequent bad effects. It is, therefore, specially applicable in such cases as contra-indicate the administration of opium, such as when, from the condition of the patient, opium is positively dangerous, or when it is found to disagree.

Chloral has been successfully employed as a *sedative* and *hypnotic*, in puerperal mania, in acute mania, in general paralysis of the insane, and in other forms of insanity; in phthisis (in which case it is found to greatly lessen the night-sweats); in rheumatic fever; in gout; in scarlet fever; in typhus and typhoid fevers; in nervous restlessness and sleeplessness; in cardiac disease; in delirium tremens, &c., &c.; in tic douloureux, and in various other forms of neuralgia.

As an *antispasmodic*, hydrate of chloral has been employed in epilepsy, in chorea, in puerperal convulsions, in uræmic convulsions, and in hooping-cough.

It is better to commence with a small dose, twenty-five to thirty grains, repeating it every hour, if necessary, till sleep is produced. In some cases, as in Dr J. R. Reynolds', dangerous symptoms have followed the administration of from fifty to sixty grains, though as much as seventy-five grains have been repeatedly given without other result than prolonged sleep.

As a sedative simply it may be administered in doses of five to fifteen grains, thrice a-day, and as such it is reported to be very beneficial in periods of mental excitement associated with insanity.

Bichloride of Methylene—($C_2H_2Cl_2$, or CH_2Cl_2)—*Synonym:* Chloride of Methylene—may be prepared by subjecting the iodide of Methylene (CH_2I_2) covered with water in a retort to the action of chlorine gas. When the retort is gently heated the bichloride of Methylene passes over as a very volatile liquid into the receiver, and the iodine separates in the crystalline form. The oily liquid is purified by heating it with chlorine and a few drops of potash ley, drying over chloride of calcium, and rectifying. It is a colourless liquid, considerably heavier than water. It has a penetrating odour very like chloroform.

It is soluble in water, and in alcohol, very soluble in ether. It does not solidify in a mixture of snow and salt, boils at 88°. Its specific gravity is 1·344, of its vapour 2·937. It has been recommended by Dr B. W. Richardson as an anæsthetic. But its odour is not nearly so agreeable as that of chloroform, so that its inhalation is not so pleasant to the patient. Besides, though it acts as a powerful anæsthetic, the trials which we have made of it tend to show that it is accompanied by more depression during the third stage, and that it would, consequently, be more liable to fatal syncope than chloroform. It seems to possess no advantage over chloroform in any respect, but to be in every way inferior to it, and is besides very much more expensive.

Chlorodyne—a nostrum which has of late been largely used, chiefly as an anodyne, antispasmodic, and soporific—is a dark-coloured liquid of treacly consistence, with a sweet, hot, and peppermint taste. It is supposed by Mr Squire to contain chloroform, rectified spirit, treacle, extract of liquorice, hydrochlorate of morphia, oil of peppermint, syrup, and prussic acid (2 per cent.) Dr Ogden suggests the following ingredients :—Chloroform, chloric ether, tincture of capsicum, oil of peppermint, hydrochlorate of morphia, hydrocyanic acid (Scheele's), perchloric acid, tincture of Indian hemp, and treacle. The dose is five, ten, or more minims, according to the formula by which it is prepared, and the circumstances of the patient.

Cerevisiæ Fermentum—Beer Yeast.—The ferment obtained in brewing beer. Officinal preparation: *Cataplasma Fermenti.*

CHARACTERS.—*Viscid, semifluid, frothy, exhibiting, under the microscope, numerous round or oval confervoid cells.*

CATAPLASMA FERMENTI—YEAST POULTICE.—*Take of beer yeast,* 6 *fluid ounces; flour,* 14 *ounces; water, heated to* 100°, 6 *fluid ounces. Mix the yeast with the water, and stir in the flour. Place the mass near the fire till it rises.*

Dose.—Of yeast, two tablespoonfuls every third hour, with an equal quantity of camphor water or peppermint water.

Yeast acts as a stimulant and antiseptic, and as such has been recommended in typhus and typhoid fevers, in which it is said to relieve tympanitic distension, and to remove petechiæ and the blackness of the tongue; it has also been employed in dysentery. The poultice is used as a stimulant and antiseptic application to sloughing parts, ill-conditioned ulcers, recent bruises, &c. It destroys the offensive odour, and promotes the separation of the dead tissues.

Creasotum—CREASOTE—A product of the distillation of Wood Tar. Officinal preparations: *Mistura Creasoti, Unguentum Creasoti, Vapor Creasoti.*

CHARACTERS.—*A liquid, colourless, or with a yellowish tinge, and a strong empyreumatic odour. It is sparingly dissolved by water, but*

freely by alcohol, ether, and glacial acetic acid. Specific gravity, 1·071. *It coagulates albumen.*

TESTS.—*A slip of deal dipped into it, and afterwards into hydrochloric acid, acquires, on exposure for a short time to the air, a greenish-blue colour. Dropped on white filtering paper and exposed to a heat of* 212°, *it leaves no translucent stain. It turns the plane of polarisation of a ray of polarised light to the right. It is not solidified by the cold produced by a mixture of hydrochloric acid and sulphate of soda.*

Creasote ($C_8H_{10}O_2$) may be obtained by the distillation of wood or of wood tar. Pure creasote is colourless and transparent, has a strong empyreumatic odour, and a burning taste. It is inflammable, burning with a sooty flame. It preserves both animal and vegetable tissues. It is distinguished from carbolic acid by having a slightly higher specific gravity; by drying up at 212°, whereas carbolic acid does not boil till 370°; by turning a ray of polarised light to the right, while carbolic acid exerts no effect upon it; and by not being solidified by the cold produced by a mixture of hydrochloric acid and sulphate of soda, whilst carbolic acid is either solid or easily solidifiable by cooling. Creasote frequently contains impurities, and a good deal of the commercial article is said to be in reality carbolic acid.

MISTURA CREASOTI—CREASOTE MIXTURE.—*Take of creasote; glacial acetic acid, of each,* 16 *minims; spirit of juniper,* ½ *fluid drachm; syrup,* 1 *fluid ounce; distilled water,* 15 *fluid ounces. Mix the creasote with the acetic acid, gradually add the water, and lastly the syrup and spirit of juniper.*

UNGUENTUM CREASOTI—OINTMENT OF CREASOTE.—*Take of creasote,* 1 *fluid drachm; simple ointment,* 1 *ounce. Mix thoroughly.*

VAPOR CREASOTI—INHALATION OF CREASOTE.—*Take of creasote,* 12 *minims; boiling water,* 8 *fluid ounces. Mix the creasote and water in an apparatus so arranged that air may be made to pass through the solution, and may afterwards be inhaled.*

Dose.—Of creasote, one or two drops, cautiously increased to four or five, dissolved in an ounce or more of water (with or without a little acetic acid, as an emulsion with mucilage), or in pill. Of the mixture, one or two fluid ounces (each fluid ounce contains one drop of creasote). For inhalation, the officinal formula may be employed.

Creasote has been classed with stimulants, sedatives, diuretics, astringents, irritants, rubefacients, caustics, antiseptics, &c. When applied to the tongue, it causes violent pain and a flow of saliva. It coagulates albumen, thereby acting as a caustic, whitening, like nitrate of silver, the surface of a wound. In over-doses it causes nausea, vomiting, vertigo, and profound stupor, with depression of the heart's action. Creasote is given to arrest vomiting, when it occurs from irritability of the stomach or other functional disturbance, without organic lesion; also in the sickness of pregnancy, as a remedy for sea-sickness, &c. It is given also to arrest chronic

mucous discharges and slight hemorrhages. It is applied externally as a styptic. It is applied, either in solution or as the ointment, to ill-conditioned bed-sores, excrescences, condylomata, ulcers, to certain chronic skin diseases, to chilblains, to burns and scalds, &c. It is given internally in diabetes, and, by inhalation, to check excessive expectoration, and to correct fetid breath and sputa, &c. It is also used as a topical application in toothache.

Acidum Carbolicum—Carbolic Acid ($HO,C_{12}H_5O$, or HC_6H_5O). *Synonyms:* Phenic Acid — Phenylic Alcohol — Phenylic Acid. Prepared from coal tar oil by fractional distillation and subsequent purification.

CHARACTERS.—*In colourless acicular crystals, which at a temperature of 95° become an oily liquid, having a strong odour and taste, resembling those of creasote, which it also resembles in many of its characters and properties. Its specific gravity,* 1·065; *boiling point,* 370°. *The crystals readily absorb moisture on exposure to the air, and they are thus liquefied; the acid, however, is but slightly soluble in water, but is freely soluble in alcohol, ether, and glycerine. It does not redden blue litmus paper.*

TESTS.—*A slip of deal dipped into it, and afterwards into hydrochloric acid, and then allowed to dry in the air, acquires a greenish-blue colour. It coagulates albumen. It does not affect the plane of polarisation of a ray of polarised light.*

Carbolic acid is distinguished from creasote by being solid at ordinary temperatures; by being of slightly lower specific gravity; by its boiling-point being higher, and by its not affecting the plane of a ray of polarised light.

Glycerinum Acidi Carbolici—Glycerine of Carbolic Acid.

PREPARATION.—*Take of carbolic acid,* 1 *ounce; glycerine,* 4 *fluid ounces. Rub them together in a mortar until the acid is dissolved.*

Dose.—Of the crystallised acid, one to three grains, thrice a-day, in pill of bread-crumb; of the glycerine, five to fifteen minims, thrice a-day. The glycerine may also be painted over the skin in diseased conditions, such as favus. But the more extended use of carbolic acid of late has necessitated the introduction of other modes of employing it. The following preparations are used by Professor Lister :—

1. Strong Carbolic Lotion.—1 of carbolic acid in 20 of water.
2. Weak Carbolic Lotion.—1 of carbolic acid in 100 of water.
3. Carbolic oil.—1 of carbolic acid to 4 of boiled linseed or other oil.
4. Carbolic Paste.—Carbolic oil made into the consistence of soft putty by admixture with whiting.
5. Various disinfected dressings, such as lac-plaster spread on soft cloth and dipped into a solution of carbolic acid; oiled silk, brushed over with a mixture of 1 part of dextrin and 2 of powdered starch, and afterwards dipped in the strong solution of carbolic acid, &c., &c.

Carbolic acid has, within the last few years, become an article of the first importance, both in the arts and in practical medicine. It

is chiefly procured from coal tar, but exists naturally in castoreum, is a product of the distillation of gum benzoin and of some other resins, is found in small quantities in the urine of man and of some other animals. As powder of lime and coal tar, it was used by the French with great success as an antiseptic dressing for wounds during the Austro-Italian war in 1859. In 1863 Dr Lemaire, of Paris, published an octavo volume on Phenylic Acid, in which he discussed Pasteur's germ theory, and maintained that it is the admission of atmospheric germs to wounds, and not the mere accession of air, which occasions suppuration and prevents healing action. He recommended carbolic acid, on antiseptic principles, as an application to scrofulous sores, burns, bites of venomous animals, dissection wounds, sloughing and gangrenous sores, caries, necrosis, abscess of joints, whitlows, carbuncles, lupus, cancerous discharges, otorrhœa, ozæna, &c., &c. Internally he advised its use in aphtha, croup, angina, dyspepsia, dysentery, cholera; in some contagious diseases, such as scarlet fever and measles; in diseases, such as ague, supposed to be due to the action of malarious poisons. Simultaneously, Dr Crum Calvert and Dr Turner of Manchester were investigating its capabilities in England. Dr Turner communicated a paper to the British Association at their meeting in Manchester in the summer of 1863, in which he advocated its use as an astringent and antiseptic application in cases of putrid discharges from mucous membranes generally, as from the mouth, nostrils, ears, rectum, &c.; as a caustic in diphtheria, carbuncle, fistula, and hæmorrhoids. Dr James Watson, now of New-chwang, China, made some trials with it in the Edinburgh Infirmary as an antiseptic and parasiticide in 1864, employing it chiefly in favus and in alopecia areata, pointing out at the same time its anti-fermentative and anti-putrescent virtues. During the same year it was recommended by Dr Wolfe, of Glasgow, as an astringent and antiseptic inhalation in phthisis and bronchitis. Guided chiefly by the very marked antiseptic results obtained from carbolic acid in Carlisle during the outbreak of cholera in 1866, Professor Lister was led to employ it as an antiseptic dressing in cases of compound fracture, lacerated wounds, abscesses, &c. He first published the results of his experiments in the *Lancet* in 1867; and to him is unquestionably due the credit of introducing carbolic acid into general use in this country, and of instituting the antiseptic treatment of wounds, which bids fair to be the greatest improvement in surgery since the introduction of anæsthetics.

Mr Syme and many other surgeons warmly supported Mr Lister's practice, and many results have been published by them which testify to the great advantage accruing from the use of carbolic acid in the dressing of wounds.

Carbolic acid is a *caustic*, if used pure or in strong solution; an astringent, stimulant, disinfectant, and antiseptic.

As a *caustic*, it has been employed in diphtheria, in carbuncle, in chancre, in the bites of rabid dogs or of venomous animals; to destroy hæmorrhoids and obliterate fistulous openings; before the closure of surgical wounds, to destroy any germs that may have attached themselves to the wounded surface during operation.

As a disinfectant and antiseptic it is used in a multitude of cases. To disinfect the sewers of large cities; to disinfect dissecting rooms; to oppose the spreading of infectious diseases, such as cholera, typhus and typhoid fever, scarlatina, measles, &c.; to prevent the effect of malarious fever-poisons; to prevent or check pyæmia; or generally to prevent suppuration or changes of a suppurative character, as in phthisis and bronchitis; to maintain a healthy condition of open wounds and promote healing by the first intention, acting, according to Lister, by destroying atmospheric germs, which, alighting upon the broken surface, would set up putrefaction; to prevent the destructive progress of inflammatory action in important organs, as in the cavities of joints, &c.; to limit the progress of malignant ulcerations, &c.; to promote the healing of abscesses, both acute and chronic; to correct putrid conditions of the urine, by being injected into the bladder.

As an astringent, stimulant, and antiseptic, it has been employed in aphthous conditions of the mouth in ozena, and polypus of the nose; to correct the fœtor of, and diminish the amount of putrid discharges from the ear, the vagina, or the rectum; as an injection in gonorrhœa and gleet; to promote the healing of chancres and putrid sores generally; also, in the treatment of weak and indolent ulcers; as an inhalation in phthisis and in bronchitis, in gangrene of the lungs, fetid sputa; in the treatment of many skin diseases, whether or not referable to parasitic origin, as in alopecia areata, tinea favosa, and psoriasis.

But carbolic acid is also frequently given internally, and with excellent effect, in the treatment of fevers of a septic nature, as in typhoid fever, in pyæmia, in scarlet fever, &c.; also when the patient suffers from suppurative action, as in abscess. In the treatment of typhoid, when there is much gastric irritability, it is better

to administer the sulpho-carbolate than the free acid. The dose of the latter is about 30 grains. Carbolic acid has lately been administered internally for psoriasis, and this practice, so far, seems to have been followed with marvellous success.

As a disinfectant, carbolic acid is much more active than the ordinary disinfectants, such as chloride of zinc and the permanganate of potash; whilst it is, at the same time, volatile, and consequently is much more easily applied, and acts far more generally. Besides, the pure acid has very little, if any, disagreeable smell. Though on the first application to a part carbolic acid is painful, yet after its continuance for some time the acid seems to exert a certain amount of anæsthetic action upon the nerves of the part. During the administration of carbolic acid the patient's urine assumes a dark, smoky-looking character.

In order to secure success with the antiseptic treatment, Lister insists upon the necessity of the antiseptic principles being rigidly adhered to in every step of the operation and treatment, and to the most minute details. The ligatures, knives, sponges, and everything that touches the wounded surface, must be disinfected. The wound must be washed with a strong disinfectant solution. If an abscess is to be opened, it must be done under a covering of lint soaked in carbolic oil, &c.

Petroleum—Rock Oil or Barbadoes Tar—is a dark-coloured, treacle-like, bituminous liquid, which flows spontaneously from the earth, and is met with on the surface of certain lakes. It was formerly much more used than at present, like common tar and pitch, as a stimulant, expectorant, sudorific, and anthelmintic, and externally as a rubefacient. It may be given in the form of emulsion, in doses of twenty minims to a fluid drachm. *Brushed gently* over the parts of the skin affected, it is a speedy and certain cure for scabies, the disease usually disappearing after a single application. It must never be *rubbed in,* or it is sure to produce an impetiginous eruption.

Succinum—Amber—yields by distillation an oil and an acid, Succinic oil (Oleum Succini), and Succinic acid. Succinic acid is said to be expectorant; the oil acts as a stimulant and antispasmodic, and externally as a rubefacient. They are very rarely used.

APPENDIX.

I.

ARTICLES EMPLOYED IN CHEMICAL TESTING (B.P.)

Alcohol (Absolute Alcohol).—See page 601.

Benzol ($C_{12}H_6$, or C_6H_6).—A colourless volatile liquid, obtained from coal tar. Specific gravity, 0·85.

Boracic Acid (BO_3, 3HO, or H_3BO_3). *Tests.*—Soluble in alcohol. The solution burns with a green flame.

Chloride of Barium (BaCl, 2HO, or $BACl_2$, $2H_2O$).

Copper Foil.—Pure metallic copper, thin and bright.

Gold, Fine.—Gold, free from metallic impurities.

Hyposulphite of Soda (NaO, $S_2O_2 + 5HO$, or $Na_2H_2S_2O_44H_2O$). *Test.*—24·8 grains decolorise 100 measures of the volumetric solution of iodine.

Indigo ($C_{16}H_5NO_2$, or C_8H_5NO).—A blue pigment prepared from various species of Indigofera, *Linn.*

Isinglass.—The swimming bladder or sound of various species of Acipenser, *Linn.*, prepared and cut into fine shreds.

Litmus—See page 589.—A blue pigment prepared from various species of Roccella, *DC.*

Litmus Paper, Blue.—Unsized white paper steeped in tincture of litmus, and dried by exposure to the air.

Litmus Paper, Red.—Unsized white paper steeped in tincture of litmus which has been previously reddened by the addition of a very minute quantity of sulphuric acid, and dried by exposure to the air.

Litmus Tincture.—Take of litmus in powder, 1 ounce; proof spirit, 10 fluid ounces. Macerate for two days in a closed vessel and filter.

Oxalic Acid of Commerce.

Oxalic Acid, Purified ($2HO, C_40_6 + 4HO$, or $H_2C_20_42H_2O$.—Take of oxalic acid of commerce, 1 pound; boiling distilled water, 30 fluid ounces. Dissolve, filter the solution, and set it aside to crystallise. Pour off the liquor, and dry the crystals by exposure to the air on filtering paper placed on porous bricks. *Test.*—It is entirely dissipated by a heat below 350°.

Oxalate of Ammonia ($2NH_4O, C_4O_6$ + 2HO, or $(NH_4)_2C_2O_4H_2O$.—Take of purified oxalic acid, 1 ounce; boiling distilled water, 8 fluid

ounces; carbonate of ammonia, a sufficiency. Dissolve the oxalic acid in the water, neutralise the solution at a boiling temperature, filter it while still hot, and set it by that crystals may form as it cools.

Plaster of Paris. — Native sulphate of lime (CaO, $SO_3 + 2HO$ or $CaSO_4 2H_2O$) deprived of water by heat.

Platinum Black.—Platinum in a state of minute division, obtained by adding excess of carbonate of soda and some sugar to solution of perchloride of platinum, and boiling until a black precipitate is formed, which is washed and dried.

Platinum Foil.

Red Prussiate of Potash ($K_3Fe_2C_{12}N_6$, or $K_6Fe_2C_{12}N_{12}$). *Test.*—Its solution in water gives no precipitate with persulphate of iron.

Subacetate of Copper of Commerce.—Verdigris.

Sulphate of Copper, Anhydrous (CuO,SO_3, or $CuSO_4$). — Sulphate of copper deprived of its water by a heat of 400°. *Characters.*—A yellowish-white powder, which becomes blue when moistened with water.

Sulphide of Iron (FeS).— Produced by applying the end of a rod of iron, heated to a white heat at a blacksmith's forge, to the end of a roll of sulphur, and allowing the sulphide of iron as it is formed to run into a vessel of water.

Sulphuretted Hydrogen (HS, or H_2S).—Take of sulphide of iron, ½ ounce; water, 4 fluid ounces; sulphuric acid, a sufficiency. Place the sulphide of iron and the water in a gas-bottle, closed with a cork perforated by two holes, through one of which passes air-tight a funnel tube of sufficient length to dip into the water, and through the other a tube for giving exit to the gas. Through the former pour from time to time a little of the acid, so as to develop the sulphuretted hydrogen as it may be required.

Tin, Granulated.—Grain tin, reduced to small fragments by fusing and pouring into cold water.

Turmeric.—The rhizome of Curcuma longa, *Linn.*

Turmeric Paper.—Unsized white paper steeped in tincture of turmeric and dried by exposure to the air.

Turmeric Tincture.—Take of turmeric, bruised, 1 ounce; rectified spirit, 6 fluid ounces. Macerate for seven days in a closed vessel, and filter.

II.

TEST SOLUTIONS (B.P.)

Solution of Acetate of Copper.—Take of subacetate of copper of commerce, in fine powder, ½ ounce; acetic acid, 1 fluid ounce; distilled water, a sufficiency. Dilute the acid with half a fluid ounce of the water; digest the subacetate of copper in the mixture at a temperature not exceeding 212° with repeated stirring, and continue the heat until

a dry residue is obtained. Digest this in four ounces of boiling distilled water, and by the addition of more of the water make up the solution to five fluid ounces. Filter it.

Solution of Acetate of Potash.—Take of acetate of potash, ½ ounce; distilled water, 5 fluid ounces. Dissolve and filter.

Solution of Acetate of Soda.—Take of acetate of soda, ½ ounce; distilled water, 5 fluid ounces. Dissolve and filter.

Solution of Albumen.—Take the white of 1 egg; distilled water, 4 fluid ounces. Mix by trituration in a mortar, and filter through clean tow first moistened with distilled water. This solution must be recently prepared.

Solution of Ammonio-Nitrate of Silver.—Take of nitrate of silver, in crystals, ¼ ounce; solution of ammonia, ½ fluid ounce, or a sufficiency; distilled water, a sufficiency. Dissolve the nitrate of silver in eight fluid ounces of the water, and to the solution add the ammonia until the precipitate first formed is nearly dissolved. Clear the solution by filtration, and then add distilled water, so that the bulk may be ten fluid ounces.

Solution of Ammonio-Sulphate of Copper.—Take of sulphate of copper, in crystals, ½ ounce; solution of ammonia, a sufficiency; distilled water, a sufficiency. Dissolve the sulphate of copper in eight fluid ounces of the water, and to the solution add the ammonia, until the precipitate first formed is nearly dissolved. Clear the solution by filtration, and then add distilled water, so that the bulk may be ten fluid ounces.

Solution of Ammonio-Sulphate of Magnesia.—Take of sulphate of magnesia, 1 ounce; chloride of ammonium, ½ ounce; solution of ammonia, ½ fluid ounce; distilled water, a sufficiency. Dissolve the sulphate of magnesia and chloride of ammonium in eight fluid ounces of the water, and to the solution add the ammonia, and as much distilled water as will make up the bulk to ten fluid ounces. Filter it.

Solution of Boracic Acid.—Take of boracic acid, 50 grains; rectified spirit, 1 fluid ounce. Dissolve and filter.

Solution of Bromine.—Take of bromine, 10 minims; distilled water, 5 fluid ounces. Place the bromine in a bottle furnished with a well-fitting stopper, pour on the water, and shake several times. Keep it excluded from the light.

Solution of Carbonate of Ammonia.—Take of carbonate of ammonia, in small pieces, ½ ounce; distilled water, 10 fluid ounces. Dissolve and filter.

Solution of Chloride of Ammonium.—Take of chloride of ammonium, 1 ounce; distilled water, 10 fluid ounces. Dissolve and filter.

Solution of Chloride of Barium.—Take of chloride of barium, in crystals, 1 ounce; distilled water, 10 fluid ounces. Dissolve and filter.

Solution of Chloride of Calcium.—Take of chloride of calcium, 1 ounce; distilled water, 10 fluid ounces. Dissolve and filter.

Solution (Saturated) of Chloride of Calcium.—Take of chloride of calcium, 4 ounces; distilled water, 5 fluid ounces. Dissolve and filter.

Solution of Chloride of Gold.—Take of fine gold, reduced by a rolling machine to a thin lamina, 60 grains; nitric acid, $1\frac{1}{2}$ fluid ounce; hydrochloric acid, 7 fluid ounces; distilled water, a sufficiency. Place the gold in a flask with the nitric acid and six fluid ounces of the hydrochloric acid, first mixed with four fluid ounces of the water, and digest until it is dissolved. Add to the solution the additional fluid ounce of hydrochloric acid, evaporate at a heat not exceeding 212° until acid vapours cease to be given off, and dissolve the chloride of gold thus obtained in five fluid ounces of distilled water. The solution should be kept in a stoppered bottle.

Solution of Chloride of Tin. — Take of granulated tin, 1 ounce; hydrochloric acid, 3 fluid ounces; distilled water, a sufficiency. Dilute the acid in a flask with one fluid ounce of the water, and, having added the tin, apply a moderate heat until gas ceases to be evolved. Add as much of the water as will make up the bulk to five fluid ounces, and transfer the solution, together with the undissolved tin, to a bottle with an accurately ground stopper.

Solution of Gelatine.—Take of isinglass, in shreds, 50 grains; warm distilled water, 5 fluid ounces. Mix and digest for half-an-hour on a water-bath with repeated shaking, and filter through clean tow moistened with distilled water.

Solution of Iodate of Potash.—Take of iodine, 50 grains; chlorate of potash, 50 grains; nitric acid, 8 minims; distilled water, $10\frac{1}{2}$ fluid ounces. Rub the iodine and chlorate of potash together to a fine powder; place the mixture in a Florence flask, and, having poured upon it half-an-ounce of the water acidulated with the nitric acid, digest at a gentle heat until the colour of the iodine disappears. Boil for one minute; then transfer the contents of the flask to a capsule, and evaporate to perfect dryness at 212°. Finally dissolve the residue in the remaining ten ounces of distilled water; filter the solution, and keep it in a stoppered bottle.

Solution of Iodide of Potassium.—Take of iodide of potassium, 1 ounce; distilled water, 10 fluid ounces. Dissolve and filter.

Solution of Oxalate of Ammonia. — Take of oxalate of ammonia, $\frac{1}{2}$ ounce; warm distilled water, 1 pint. Dissolve and filter.

Solution of Perchloride of Platinum.—Take of thin platinum foil, $\frac{1}{4}$ ounce; nitric acid, a sufficiency; hydrochloric acid, a sufficiency; distilled water, 7 fluid ounces. Mix a fluid ounce of the nitric acid with four fluid ounces of the hydrochloric acid and two fluid ounces of the water; pour the mixture into a small flask containing the platinum, and digest at a gentle heat, adding more of the acids mixed in the same proportion, should this be necessary, until the metal is dissolved. Transfer the solution to a porcelain dish, add to it a fluid drachm of hydrochloric acid, and evaporate on a water-bath, until acid vapours cease to be given off. Let the residue be dissolved in the remaining five ounces of distilled water. Filter and preserve it in a stoppered bottle.

Solution of Phosphate of Soda.—Take of phosphate of soda, in crystals, 1 ounce; distilled water, 10 fluid ounces. Dissolve and filter.

Solution of Red Prussiate of Potash.—Take of red prussiate of potash, in crystals, $\frac{1}{4}$ ounce; distilled water, 5 fluid ounces. Dissolve and filter.

Solution of Sulphate of Indigo.—Take of indigo, dry, and in fine powder, 5 grains; sulphuric acid, 10 fluid ounces. Mix the indigo with a fluid drachm of the sulphuric acid in a small test-tube, and apply the heat of a water-bath for an hour. Pour the blue liquid into the remainder of the acid, agitate the mixture, and, when the undissolved indigo has subsided, decant the clear liquid into a stoppered bottle.

Solution of Sulphate of Iron.—Take of granulated sulphate of iron, 10 grains; boiling distilled water, 1 fluid ounce. Dissolve and filter. This solution should be recently prepared.

Solution of Sulphate of Lime.—Take of plaster of Paris, $\frac{1}{4}$ ounce; distilled water, 1 pint. Rub the plaster of Paris in a porcelain mortar for a few minutes with two ounces of the water, introduce the mixture thus obtained into a pint bottle containing the rest of the water, shake well several times, and allow the undissolved sulphate to subside. When this has occurred, filter.

Solution of Sulphide of Ammonium.—Take of solution of ammonia, 5 fluid ounces. Put three fluid ounces of the ammonia into a bottle, and conduct into this a stream of sulphuretted hydrogen so long as the gas continues to be absorbed; then add the remainder of the ammonia, and transfer the solution to a green-glass bottle furnished with a well-ground stopper.

Solution of Tartaric Acid.—Take of tartaric acid, in crystals, 1 ounce; distilled water, 8 fluid ounces; rectified spirit, 2 fluid ounces. Dissolve the tartaric acid in the water, add the rectified spirit, and preserve the solution in a stoppered bottle.

Solution of Yellow Prussiate of Potash.—Take of yellow prussiate of potash, in crystals, $\frac{1}{4}$ ounce; distilled water, 5 fluid ounces. Dissolve and filter.

III.

TEST SOLUTIONS FOR VOLUMETRIC ESTIMATIONS (B.P.)

The processes for volumetric estimations may be performed either with British or with metrical weights and measures, and the solutions are so arranged that they will be of the same strength, and the same indications will be obtained in using them, whichever system is employed, without the *necessity* of altering any of the figures by which the quantities of the substances tested or of the test solutions required in the process, are expressed.

According to the British system, the quantities of the substances to be tested are expressed in grains by weight, whilst the quantities of the

test solutions employed in testing are expressed in grain-measures,—the grain-measure being the volume of a grain of distilled water.

According to the metrical system the quantities of the substances to be tested are expressed in grammes by weight, whilst the quantities of the test solutions employed in testing are expressed in cubic centimetres, —the cubic centimetre being the volume of a gramme of distilled water.

As the cubic centimetre bears the same relation to the gramme that the grain-measure bears to the grain, the one system may be substituted for the other with no difference in the results, excepting that, by the metrical system, all the quantities will be expressed in relation to a weight (the gramme) which is more than fifteen times as great as the British grain.

In practice it will be found convenient in substituting metrical for British weights and measures, to reduce the values of all the numbers to one-tenth, by moving the decimal points, and this has been done in the tables appended to the descriptions of the volumetric solutions. The quantities indicated in the Pharmacopœia, which in grains and grain-measures can be conveniently used, would be found inconveniently large if the same numbers of grammes and cubic centimetres were employed.

The following apparatus is required in the preparation and use of these solutions.

For British weights and measures:—

1. A flask which, when filled to a mark on the neck, contains exactly 10,000 grains of distilled water at 60°. The capacity of the flask is therefore 10,000 grain-measures.

2. A graduated cylindrical jar which, when filled to 0, holds 10,000 grains of distilled water, and is divided into 100 equal parts.

3. A burette. A graduated glass tube which, when filled to 0, holds 1,000 grains of distilled water, and is divided into 100 equal parts. Each part therefore corresponds to 10 grain-measures.

For metrical weights and measures:—

1. A glass flask which, when filled to a mark on the neck, contains one litre or 1,000 cubic centimetres.

2. A graduated cylindrical jar which, when filled to 0, contains one litre (1,000 cubic centimetres), and is divided into 100 equal parts.

3. A burette. A graduated tube which, when filled to 0, holds 100 cubic centimetres, and is divided into 100 equal parts.

(One cubic centimetre is the volume of one gramme of distilled water at 4°C.* 1,000 cubic centimetres equal one litre.)

Volumetric solutions, before being used, should be shaken, in order that they may be throughout of uniform strength. They should also be preserved in stoppered bottles. All measurements should be made at 60°.

Volumetric Solution of Bichromate of Potash (Bichromate of Potash, $KO,2CrO_3 = 147{\cdot}5$, or $K_2Cr_2O_7 = 295$.)—Take of Bichromate of Potash, 147.5 grains; distilled water, a sufficiency. Put the bichromate of potash into the 10,000 grain flask, and, having half-filled the flask with water, allow the salt to dissolve; then dilute the solution with more water, until it has the exact bulk of 10,000 grain-measures. 1,000 grain-measures of this solution contain 14.75 grains of the bichromate

* It is customary to make the measurements with metrical apparatus at 60° Fahr.

($\frac{1}{10}$th of $KO,2CrO_3$, or $\frac{1}{20}$th of $K_2Cr_2O_7$, in grains), and when added to a solution of a protosalt of iron acidulated with hydrochloric acid, are capable of converting 16·8 grains of iron ($\frac{1}{10}$th of 6Fe, or $\frac{1}{20}$th of 6Fe, new notation, in grains) from the state of protosalt to that of persalt.

Grammes and cubic centimetres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. Thus 14.75 grammes of bichromate of potash should be made to form 1,000 cubic centimetres of solution. 100 cubic centimetres of this solution contain 1·475 grammes of the bichromate ($\frac{1}{100}$th of $KO,2CrO_3$, or $\frac{1}{200}$th of $K_2Cr_2O_7$, in grammes), and when added to a solution of protosalt of iron acidulated with hydrochloric acid are capable of converting 1·68 grammes of iron ($\frac{1}{100}$th of 6Fe, or $\frac{1}{200}$th of 6Fe, new notation, in grammes) from the state of protosalt to that of persalt.

This solution is used for determining the proportion of protoxide of iron in the following preparations. It is known that the whole of the protosalt has been converted into a persalt when a minute drop of the liquid, placed in contact with a drop of the solution of red prussiate of potash on a white plate, ceases to strike with it a blue colour.

	British weights and measures.				Metrical weights and measures.		
	Grains weight of Substance.	=	Grain-measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Ferri Arsenias .	20	=	170	or	2·0	=	17·0
„ Carb. Sach.	20	=	330	or	2·0	=	33·0
„ Oxid. Magn.	20	=	83·0	or	2·0	=	8·3
„ Phosphas	20	=	250	or	2·0	=	25·0

Volumetric Solution of Hyposulphyte of Soda (Hyposulphite of Soda crystallised, $NaO,S_2O_2+5HO=124$, or $Na_2H_2S_2O_44H_2O=248$).—Take of hyposulphite of soda, in crystals, 280 grains; distilled water, a sufficiency.

Dissolve the hyposulphite of soda in 10,000 grain-measures of water. Fill a burette with this solution, and drop it cautiously into 1,000 grain-measures of the volumetric solution of iodine, until the brown colour is just discharged. Note the number of grain-measures (n) required to produce this effect; then put 8,000 grain-measures of the same solution into a graduated jar, and augment this quantity by the addition of distilled water until it amounts to $\frac{8000 \times 1000}{n}$ grain-measures. If, for example, $n=950$ the 8,000 grain-measures of solution should be diluted to the bulk of $\frac{8000 \times 1000}{950}=8,421$ grain-measures. 1,000 grain-measures of this solution contain 24·8 grains of the hyposulphite ($\frac{1}{10}$th of $2(NaO, S_2O_2+5HO)$, or $\frac{1}{10}$th of $Na_2H_2S_2O_44H_2O$, in grains), and therefore correspond to 12·7 grains of iodine ($\frac{1}{10}$th of an equivalent).

Grammes and cubic centimetres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres of this solution contain 2·48 grammes of the hyposulphite ($\frac{1}{100}$th of $2(NaO, S_2O_2+5HO$, or $\frac{1}{100}$th of $Na_2H_2S_2O_44H_2O$, in grammes), and therefore correspond to 1·27 grains of iodine ($\frac{1}{100}$th of an equivalent).

This solution is used for testing the following substances. In each

case, excepting that of iodum, a solution of iodide of potassium and hydrochloric acid are added to the substance, and the amount of iodine so liberated is indicated by this solution.

	British weights and measures.				Metrical weights and measures.		
	Grains weight of Substance.	=	Grain-measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Calx Chlorata . .	10·0	=	850	or	1·00	=	85·0
Iodum . . .	12·7	=	1000	or	1·27	=	100·0
Liq. Calc. Chloratæ .	60·0	=	500	or	6·00	=	50·0
" Chlori . .	439·0	=	750	or	43·90	=	75·0
" Sodæ Chloratæ .	70·0	=	500	or	7·00	=	50·0

Volumetric Solution of Iodine (Iodine, I = 127).—Take of iodine, 127 grains; iodide of potassium, 180 grains; distilled water, a sufficiency. Put the iodide of potassium and the iodine into the 10,000 grain flask, fill the flask to about two-thirds its bulk with distilled water, gently agitate until solution is complete, and then dilute the solution with more water until it has the exact volume of 10,000 grain-measures. 1,000 grain-measures of this solution contain $\frac{1}{10}$th of an equivalent in grains (12·7 grains) of iodine, and therefore correspond to 1·7 grains of sulphuretted hydrogen, 3·2 grains of sulphurous, and 4.95 grains of arsenious acid.

Grammes and cubic centimetres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres contain 1·27 grammes of iodine, and correspond to 0.17 grammes of sulphuretted hydrogen, 0·32 grammes of sulphurous, and 0·495 grammes of arsenious acid.

This solution is used for testing the following substances. It is dropped from the burette into the liquid to be tested until free iodine begins to appear in the solution.

	British weights and measures.				Metrical weights and measures.		
	Grains weight of Substance.	=	Grain-measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Acid. Arseniosum .	4·0	=	808	or	0·40	=	80·8
" Sulphurosum .	34·7	=	1000	or	3·47	=	100·0
Liquor Arsenicalis .	441·5	=	808	or	44·15	=	80·8
" Arsenici Hydrochloricus	441·5	=	810	or	44·15	=	81·0

Volumetric Solution of Nitrate of Silver (Nitrate of Silver, AgO,NO_5 = 170 or $AgNO_3$ = 170).—Take of nitrate of silver, 170 grains; distilled water, a sufficiency. Put the nitrate of silver into the 10,000 grain flask, and, having half-filled the flask with water, allow the salt to dissolve; then dilute the solution with more water until it has the exact bulk of 10,000 grain-measures. The solution should be kept in an opaque stoppered bottle. 1,000 grain-measures of this solution contain $\frac{1}{10}$th of an equivalent in grains of nitrate of silver (or 17·0 grains).

Grammes and cubic centimetres may be employed instead of grains

and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres contain $\frac{1}{100}$th of an equivalent in grammes of nitrate of silver (or 1·7 grammes).

It is used in testing the following substances:—

	British weights and measures.				Metrical weights and measures.		
	Grains weight of Substance.	=	Grain-measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Acid. Hydrocyan.	270	=	1000	or	27·0	=	100·0
Potass. Bromid.	10	=	840	or	1·0	=	84·0
Sodæ Arsenias (dry)	10	=	1613	or	1·0	=	161·3

Volumetric Solution of Oxalic Acid (Crystallised Oxalic Acid, $2HO,C_4O_6+4HO=126$, or $H_2C_2O_42H_2O=126$).—Take of purified oxalic acid in crystals, quite dry, but not effloresced, 630 grains; distilled water, a sufficiency.

Put the oxalic acid into the 10,000 grain flask, fill the flask to about two-thirds of its bulk with water, allow the acid to dissolve, and then dilute the solution with more water, until it has the exact volume of 10,000 grain-measures. 1,000 grain-measures of this solution contain half an equivalent in grains (63 grains) of oxalic acid, and are therefore capable of neutralising one equivalent in grains of an alkali or alkaline carbonate.

Grammes and cubic centimetres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres contain $\frac{1}{20}$th of an equivalent in grammes (6.3 grammes) of oxalic acid, and will neutralise $\frac{1}{10}$th of an equivalent in grammes of an alkali.

The following substances are tested with this solution:—

	British weights and measures.				Metrical weights and measures.		
	Grains weight of Substance.	=	Grain-measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Ammoniæ Carb.	59·0	=	1000	or	5·90	=	100·0
Borax	191·0	=	1800	or	19·10	=	100·0
Liq. Ammon.	85·0	=	500	or	8·50	=	50·0
" " Fort.	52·3	=	1000	or	5·23	=	100·0
" Calcis	4380·0	=	200	or	438·00	=	20·0
" " Sacchar.	46·0	=	254	or	46·02	=	25·4
" Plumbi Subacet.	413·3	=	810	or	41·33	=	81·0
" Potassæ	462·9	=	482	or	46·29	=	48·2
" " efferves.	4380·0	=	150	or	438·0	=	15·0
" Sodæ "	458·0	=	470	or	45·80	=	47·0
" " efferves.	4380·0	=	178	or	438·0	=	17·8
Plumbi Acetas	38·0	=	200	or	3·80	=	20·0
Potassa Caustica	56·0	=	900	or	5·60	=	90·0
Potassæ Bicarb.	50·0	=	500	or	5·00	=	50·0
" Carb.	83·0	=	980	or	8·30	=	98·0
" Citras	102·0	=	1000	or	10·20	=	100·0

	British weights and measures.				Metrical weights and measures.		
	Grains weight of Substauce.	=	Grain-measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Potassæ Tartras .	113·0	=	1000	or	11·30	=	100·0
" " Acida	188·0	=	1000	or	18·80	=	100·0
Soda Caustica . .	40·0	=	900	or	4·00	=	90·0
" Tartarata .	141·0	=	1000	or	14·1	=	100·0
Sodæ Bicarb. . .	84·0	=	1000	or	8·40	=	100·0
" Carb. . .	143·0	=	960	or	14·30	=	96·0

Volumetric Solution of Soda (Hydrate of Soda, NaO,HO = 40 or NaHO = 40).—Take of solution of soda, a sufficiency; distilled water, a sufficiency.

Fill a burette with the solution of soda, and cautiously drop this into 63 grains of purified oxalic acid dissolved in about two ounces of water, until the acid is exactly neutralised as indicated by litmus. Note the number of grain-measures (n) of the solution used, and having then introduced 9,000 grain-measures of the solution of soda into a graduated jar, augment this quantity by the addition of water, until it becomes $\frac{9000 \times 1000}{n}$ grain-measures. If, for example, $n = 930$, the 9,000 grain-measures should be augmented to $\frac{9000 \times 1000}{930} = 9{,}677$ grain-measures. 1,000 grain-measures of this solution contain one equivalent in grains (40 grains) of hydrate of soda, and will therefore neutralise one equivalent in grains of any monobasic acid.

Grammes and cubic centimetres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres contain $\frac{1}{10}$th of an equivalent in grammes (4 grammes) of hydrate of soda, and will neutralise $\frac{1}{10}$th of an equivalent in grammes of an acid.

This solution is used for testing the following substances:—

	British weights and measures.				Metrical weights and measures.		
	Grains weight of Substance.	=	Grain-measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Acetum . . .	445·4	=	402	or	44·54	=	40·2
Acid. Acet. . .	182·0	=	1000	or	18·20	=	100·0
" " Dil. .	440·0	=	313	or	44.00	=	31·3
" " Glac. .	60·0	=	990	or	6·00	=	99·0
" Citric. . .	70·0	=	1000	or	7·00	=	100·0
" Hydrochl. .	114·8	=	1000	or	11·48	=	100·0
" " Dil. .	345·0	=	1000	or	34·50	=	100·0
" Nitric. . .	90·0	=	1000	or	9·00	=	100·0
" " Dil. .	361·3	=	1000	or	36·13	=	100·0
" Nitro-Hydroc. Dil.	352·4	=	920	or	35·24	=	92·0
" Sulph. . .	50·6	=	1000	or	5·06	=	100·0
" " Arom. .	304·2	=	830	or	30·42	=	83·0
" " Dil. .	359·0	=	1000	or	35·90	=	100·0
" Tart. Dil. .	75·0	=	1000	or	7·50	=	100·0

SYMBOLS AND EQUIVALENT WEIGHTS OF THE ELEMENTARY BODIES MENTIONED IN THE BRITISH PHARMACOPŒIA.

Elementary Bodies.	Symbols.	Equivalents.	
		Old System.	New System.
Aluminium	Al	13·75	27·5
Antimony (Stibium)	Sb	122	122
Arsenic	As	75	75
Barium	Ba	68·5	137
Bismuth	Bi	210	210
Boron	B	11	11
Bromine	Br	80	80
Cadmium	Cd	56	112
Calcium	Ca	20	40
Carbon	C	6	12
Cerium	Ce	46	92
Chlorine	Cl	35·5	35·5
Chromium	Cr	26·25	525
Copper (Cuprum)	Cu	31·75	63·5
Gold (Aurum)	Au	196·5	196·5
Hydrogen	H	1	1
Iodine	I	127	127
Iron (Ferrum)	Fe	28	56
Lead (Plumbum)	Pb	103·5	207
Lithium	L	7	7
Magnesium	Mg	12	24
Manganese	Mn	27·5	55
Mercury (Hydrargyrum)	Hg	100	200
Nitrogen	N	14	14
Oxygen	O	8	16
Phosphorus	P	31	31
Platinum	Pt	98·5	197
Potassium (Kalium)	K	39	39
Silver (Argentum)	Ag	108	108
Sodium (Natrium)	Na	23	23
Sulphur	S	16	32
Tin (Stannum)	Sn	59	118
Zinc	Zn	32·5	65

INDEX.

*Substances marked * are Officinal.*

THE END.

LORIMER AND GILLIES, PRINTERS, CLYDE STREET, EDINBURGH.